change made in the patient's position every hour, he should be encouraged to breathe forcefully every hour, and carbon dioxide may be added to the oxygen occasionally. In order that invaluable information be not lost, and for the sake of uniformity, each surgical unit should be obliged from headquarters to keep records of each case, along standard lines, of all that specially pertains to anaesthesia." 9 references.

J. C. M. C.

BUTLER, T. C.: *The Delay in Onset of Action of Intravenously Injected Anesthetics.* J. Pharmacol. & Exper. Therap. 74: 118–128 (Feb.) 1942.

"The delay that occurs between the intravenous introduction of certain narcotics and the full development of their action has attracted relatively little attention and has not been satisfactorily explained. The first narcotic found to show this lag was α-d-glucochloralose. . . . The only drugs that I have found to have this property are chloraloses and 5, 5-disubstituted derivatives of barbituric acid and hydantoin. The lags of a number of these drugs have been measured at doses designed to give comparable depths of anesthesia. Among the eighteen 5, 5-disubstituted barbituric acids studied, it has been demonstrated that anesthetic dose and lag are associated properties, the more active drugs tending to have more rapid onset of action. This association might be explained if it were assumed that the delay is the time required for the drug to penetrate into or through the cell membrane, the more rapid penetration of the more active drugs being due to their greater relative solubility in the lipoids of the membrane. This hypothesis is inadequate to explain the unequal rates of onset of the antipodal arabinochloraloses. No reason is apparent for the fact that the property of slow onset of action is limited to those chemical classes named." 15 references.

J. C. M. C.

LONG, C. H., AND OCHSNER, ALTON: *Intravenous Pentothal Sodium Anesthesia: a Review of the Literature.* Surgery 11: 474–495 (Mar.) 1942.

"The successful use of pentothal sodium as an intravenous anesthetic by numerous groups, and its recommendation by some as 'one of the most valuable advances in the science of anesthesia that has been made in recent times,' make a thorough consideration of this agent mandatory upon progressive anesthetists and upon surgeons who assume part of the responsibility of directing the anesthetic control of their patients. This review is made in an attempt to evaluate this anesthetic agent. Since it is the opinion of many pharmacologists that there is slight hope of producing additional effective members of the barbiturate group, pentothal sodium may remain the barbiturate most acceptable for anesthesia. Various intravenous anesthetic agents had been used prior to the introduction of sodium pentothal. . . . The barbituric acid compounds were first introduced as intravenous anesthetic agents in 1929 when an attempt was made to utilize sodium amytal. . . . Although pentothal sodium had been developed earlier, by Tabern and Volwiler, it first was used clinically by Lundy at the Mayo Clinic during the latter six months of 1934. Since that time he and others have reported its use in 54,851 cases with almost universal praise of its anesthetic properties. . . .

"Pentothal sodium, or sodium ethyl (1 methylbutyl) thiobarbiturate, owes its success as an anesthetic agent to the fact that like evipal it belongs to the group of so-called 'light' or short-

acting barbiturates. . . . The pharmacologic action of pentothal sodium has been subjected to close scrutiny by numerous investigators. Its effects upon the circulatory system are minimal, no significant changes having been observed clinically in the pulse volume and rate, the blood pressure, or electrocardiographic tracings. . . . The well-recognized vasodilatation which accompanies administration of pentothal has been utilized in diagnostic tests for peripheral vascular disease and as a prognostic agent in the preoperative consideration of essential hypertension. Investigations by Reynolds and Veal suggest the possibility that continuous administration of small amounts of pentothal sodium may result in heart muscle poisoning. . . . It is Mousel's opinion that cardiovascular collapse is secondary to anoxemia caused by prolonged respiratory arrest. No such occurrence of cardiac failure during pentothal anesthesia is recorded in the clinical reports. Pentothal sodium causes a very definite respiratory depression. . . . Whereas the final disposition of pentothal in the body has never been clearly demonstrated, it has been assumed that it is detoxified in the liver. . . . Marshall mentions the administration of sulfanilamide as a contraindication to intravenous pentothal anesthesia. Adriani, in investigations with rats to which sulfanilamide had been given, found that subanesthetic doses of pentothal became anesthetic, and that doses that were anesthetic to untreated animals were usually lethal to the sulfanilamized group. Lundy reports that jaundice and general malaise have been observed clinically after the concurrent use of the two drugs. He and Adams suggest that pentothal not be used within twenty-four or forty-eight hours after the administration of another sulfur-containing drug. Other writers have sounded the same warning. However, Nosworthy and Smith report the administration of pentothal to patients to whom sulfapyridine had been given in large doses without demonstrable ill effects. Clinicopathologic observations, as reported by several authors, have demonstrated no significant changes in blood sugar, nonprotein nitrogen, uric acid, creatinine, and the Quick hippuric acid tests following sodium pentothal anesthesia. Kidney function as indicated by urinalysis is not affected. Mild variations in blood sugar levels have not been of sufficient degree to influence sodium pentothal's favored use as an anesthetic of choice in diabetes. Experimental work to determine the minimal lethal dose of pentothal sodium in rabbits and dogs has proved this value to be approximately 35 mg. per kilogram of body weight, one-half of which amount gives satisfactory anesthesia. . . . Since immediate death of experimental animals after overdosage has been demonstrated to be due to respiratory paralysis without the effect of any other pathologic process, it follows logically that the recommended antidotes for pentothal sodium are various respiratory stimulants such as coramine, picrotoxin, alpha-lobeline, metrazol, oxygen, and carbon dioxide. . . . Picrotoxin is reported to be the most effective antidote for pentothal. However, with its use there is a dangerous depression of cortical activity which comes on just before the onset of convulsions. . . .

"The introduction of two important improvements in the technique of administration of intravenous anesthetic drugs made it possible for pentothal sodium to become an effective agent for general anesthesia. The first of these innovations was the development of the intermittent method of administration in which the anesthetic solution is injected as the indication arises. This technique permits the

maintenance of an even anesthesia, and because of the rapidity of the destruction of the drug, makes sodium pentothal anesthesia as controllable and its use as safe as that of any inhalation anesthetic. The second fundamental improvement in the technique of administration was the wide adoption of the continuous administration of oxygen during anesthesia. . . . In pursuing the literature, one is impressed with the diversity of opinions concerning the scope of the usefulness of pentothal sodium. Many clinicians advise its use only for short anesthetics and in operations not requiring marked muscular relaxation. . . . Others have doubted that there are any contraindications to its use and indeed list so-called contraindications as actual indications for intravenous sodium pentothal. . . . Pentothal sodium is compatible clinically with all other common anesthetic agents and may be used as a supplement to local, regional, or inhalation anesthetics. . . . Pentothal is finding increasing use as a supplement to spinal anesthesia both to prolong the anesthesia, when the operative procedure consumes more than the expected time, and to cause unconsciousness in the patient undergoing a long operation under spinal anesthesia. . . . Aside from offering a considerable margin of safety and a wide utility, a good anesthetic should be acceptable to the patient. That this is true of pentothal sodium is adequately attested by the testimony of those to whom it has been administered. . . . Induction is a matter of a few seconds after the injection is begun. . . . One of the most desirable characteristics of the recovery period following intravenous pentothal is the patient's freedom from nausea and vomiting. . . . Some of the most ardent exponents of pentothal are those men who have employed it in the field of obstetrics. . . . Intravenous pentothal sodium is proving valuable to British anesthetists in the exigencies of military surgery. It is of particular value to victims of chemical warfare when it is desirable to use an anesthetic agent which is not irritating to the lungs. Solutions are relatively stable for from twenty-four to forty-eight hours, and as much as 500 cc. can be made up at once and used over that period. Because of the availability of the drug, the ease with which it is transported and administered, the short induction time and the quiet recovery, important time and energy can be conserved when one anesthetist must be responsible for numerous anesthesias in a short period. . . .

"The apparatus used for intravenous pentothal administration may be as simple as a sterile syringe and a small-bore intravenous needle. Various amplifications of these have consisted largely of apparatus for stabilizing the source of supply of the anesthetic solution. . . . Preoperative sedation with a 'heavy' barbiturate, an opiate, and atropine is considered generally to be desirable, although a few anesthetists prefer to use nothing besides atropine preoperatively in order to avoid undue depression during and following operation. . . . The pentothal sodium is dissolved in sufficient distilled water to make the desired solution. Since it has been shown that the incidence of phlebitis in the vein receiving the solution is directly proportionate to the concentration of the drug (1 case in 1,000 with the use of 5 per cent solution; 1 case in 3,000 with 2.5 per cent solution), a concentration of 5 or 2.5 per cent is usually employed for induction of anesthesia while a 2.5 or 1.25 per cent solution is used for subsequent injections. No established dosage can be indicated because of the marked variation in individual susceptibility, but it has been stated that the necessary

dosage varies directly as the muscular component of the patient. . . . A complete review of all the American and British literature has been made and a series of 54,851 anesthesias by intravenous pentothal sodium has been collected. Twelve deaths are reported to have occurred during anesthesia, two afterward. . . . Remarkable in this collection of 54,851 cases is the absence of any single report of postoperative pulmonary collapse or pneumonia; symptoms of milder respiratory complications were almost as rare. . . . As in the use of all other types of anesthesia, the greatest danger to the patient lies in the administration of intravenous pentothal by inexperienced anesthetists." 209 references.

J. C. M. C.

SAHLER, S. L.; KELLOGG, J. F., AND PHILLIPS, R. B.: *Cyclopropane Anesthesia at the Rochester General Hospital: Review of 7,120 Cases.* J. A. M. A. 118: 1042–1045 (Mar. 28) 1942.

"Our purpose in this paper is to present a review of 7,120 cases in which cyclopropane has been used at the Rochester Hospital [New York] during the years 1935–1940 inclusive. . . . We in Rochester feel fortunate with regard to our relative humidity, as our position on Lake Ontario gives us a relatively high humidity, a fact which tends to prevent static electricity explosions. . . . The question of excessive bleeding in the surgical field has been the subject of investigation. . . . Our own surgeons feel that the advantages in using cyclopropane greatly outweigh the slight to moderate excess oozing which frequently does occur. . . . We have used cyclopropane in almost every type of surgery. . . . It has been necessary to supplement cyclopropane with ether in 6 per cent of the cases of abdominal surgery, although frequently but small amounts of ether were used. . . .

"We have found that cyclopropane is of special merit in cesarean section. The patients do not perspire as they used to, the babies seldom have to be resuscitated, and it is possible to flush oxygen through the mother's blood and into the baby just before the cord is cut. We have had only 4 deaths in 423 cesarean sections in the last twelve years, and none under cyclopropane. One death was due to embolus on the thirteenth postoperative day. It is of the utmost importance that the patient be provided with a good airway during cyclopropane anesthesia. . . . It has been found that cyclopropane combined with basal avertin with amylene hydrate makes an excellent combination anesthesia for toxic thyroid surgery. . . . It has been found that cyclopropane is very useful as an adjunct to spinal anesthesia. . . . At the Rochester General Hospital we use the carbon dioxide absorption technic in nearly every case. . . .

"Preoperatively we use morphine, scopolamine, soluble pentobarbital, seconal . . . and combinations of these drugs. . . . We have found that helium is often of considerable help in carrying the cyclopropane and oxygen through a compressed trachea or other obstruction to the airway. We also use helium occasionally toward the end of an operation, particularly a longer one. . . . We feel that as long as the pulse remains over 50 the patient is not in immediate danger, but with slowing of the pulse we advance the oxygen intake. . . . It is well known now that one must not give drugs preoperatively that increase sympathetic tonus. We find that cyclopropane is well tolerated by all age groups. . . . We use intravenous fluids in good measure in all cases of cyclopropane anesthesia of any duration and when the surgery has been of any magnitude.