AN EVALUATION OF ANESTHETIC
DRUGS AND METHODS

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A consideration of the historical background of anesthesia in its contributing aspect to the subject of this paper would lead us into too many fascinating by-paths and occupy more time than could reasonably allotted. We must therefore only touch lightly upon such links as connect the past with the present.

The real beginning of anesthesia was toward the close of the 18th century, when the brilliant discovery of hydrogen in 1766 by Cavendish, nitrogen in 1772 by Rutherford and oxygen and nitrous-oxide by Priestley in 1774, paved the way for inhalation anesthesia; following events culminating in the successful use of ether vapor as an anesthetic by Dr. Crawford Long of Jefferson County, Georgia, in 1842. Later, in 1844, Horace Wells, of Hartford, Connecticut, attempted, but unsuccessfully, the use of nitrous-oxide gas for the same purpose. Chloroform, discovered by Flourens in 1847, was used for anesthetic purposes by Simpson of Liverpool, England, in that same year. Flourens also brought attention to the anesthetic properties of ethyl chloride, but in spite of many attempts, the drug has never taken the place of a major anesthetic, its use being limited as a preliminary to ether — and for short anesthesia in young children. It is also used as an anesthetizing spray.

Ether and chloroform, once accepted, became widely used and for many years held the field. Today ether is still an important anesthetic and perhaps the most useful, due to the simplicity of administration and ability to produce anesthesia without supplementary aid. Ether is also invaluable as a supplement to gas anesthesia; greatly increasing its usefulness and widening its application.

As a result of recent research (by Goldschmidt and co-workers, University of Pennsylvania) divinyl ether has been added to our list of inhalation anesthetics. While it is premature to predict, with any degree of certainty, the place it will occupy in the future, clinical experiences, already published, give promise of value. Until further work verifies this favorable report, it should be used with caution.

Chloroform, for many years a prime favorite, is being widely discarded, doubtless due to the fact of its now known uncertain and damaging action. This loss of place has not occurred without great effort on the part of its adherents to keep the drug in active use. Even today, an heroic attempt is being made to persuade us of its safety, if vaporized with oxygen and low percentages of carbon dioxide. Some authorities emphasize the usefulness of chloroform in operations upon the upper respiratory tract, necessitating the use of the actual cautery or diathermy.

Both of these anesthetics have run the gamut of praise and blame and as a result of early trial and error, and later intelligent research, not only have methods of administration greatly improved, but more precise
knowledge of the dangers attendant on their use are known and safeguarding measures established.

One of the first of these protecting methods was the use of premedication. The idea originally came from Claude Bernard who reported experiments on dogs, using morphine as a preliminary drug. Following this example Alexander Crombil, a surgeon of Calcutta Medical Hospital, advocated morphine as a preliminary to chloroform in humans. The history of pre-anesthetic hypnotics and narcotics is, in itself, of engrossing interest. Suffice to state here that from this simple beginning, we have today a fairly wide selection of drugs that can be safely used for preliminary medication, the definite object of their use being to cut down the psychic disturbances of the patient and lessen the amount of the inhalation anesthetic.

Further study has evolved the use of sequence and combination methods, and still further elaboration includes the use of synergists and basal anesthetics. With these more recent developments this paper is particularly concerned.

Before this comparatively recent work can be logically considered we must deal briefly indeed, with the function of pure oxygen in anesthesia. Early work in oxygen, originating with Priestley, was followed up by Bert, DeMarquay, Richet, Haldane, MacLeod, and many others. Dr. Andrews of Chicago is however the one credited with first applying its use to anesthesia. In 1868 he published the fact that by combining pure oxygen with nitrous oxide, a non-asphyxial form of anesthesia was produced. This discovery established nitrous oxide as a specific anesthetic and emphasized the necessity of preventing its asphyxial effects, by the exclusion of atmospheric air and combining with it controlling percentages of pure oxygen. Neudorfer of Vienna, in 1886, advocated the use of oxygen with chloroform and Kreutzman of San Francisco wrote of the use of a simple apparatus for giving chloroform-oxygen anesthesia. Today it is recognized that oxygen, essential with gases, also increases the safety of any anesthetic. Gwathmey of New York deserves great credit for research work done on this subject.

Recent and increasingly significant research on oxygen need during anesthesia, is particularly valuable in its application to the handicapped patient. It is now an accepted fact that in patients suffering from cardio-renal diseases, septic toxemias, reduced hemoglobin, respiratory affections, disturbed metabolic conditions such as diabetes and hyper-thyroidism (Basedow's disease) increasing oxygen over 20 per cent is necessary to maintain safety during anesthesia and to protect against damaging post-operative acidosis. Patients in shock during anesthesia require not only the diminution of the anesthetic but an increase of oxygen. Cannon states that in first degree shock the oxygen need is from 20 per cent to 30 per cent, second degree shock 30 per cent to 40 per cent and third degree shock 40 per cent and upwards. Practical application of Cannon's work was made during the Great War to shocked and exsanguined soldiers. The role of oxygen in preventing dangerous anoxemia is therefore of prime importance. The beneficial effects of oxygen therapy in combating endangering air limitation and cardiac strain, occurring in
pneumonias and other cardiac and respiratory conditions, needs no comment. We are today steadily increasing the scope of oxygen therapy and modern means for its efficient control and application are evidenced by the increasing use of oxygen tents and better control of intake by inhalation methods.

An understanding of the function of carbon dioxide in anesthesia, secured either by rebreathing or adding a known percentage of the gas to the anesthetic mixture, has given us a surprising control of respiration during operation; the result of which is not only evidenced by a smoother anesthesia but contributes greatly to the safety of the patient both during operation and post-anesthetic. Briefly, carbon dioxide is used in induction stage to increase the volume of breathing, thus facilitating the movement of the gases and hastening sleep; in the maintenance stage to correct respiratory depression from any cause. It is also of great value in stimulating respirations when the blood pressure is falling, the direct effect of carbon dioxide on the vascular tone being contributing cause to the rise of blood pressure and the increased volume of breathing produced allows for a better diffusion of necessary oxygen. It is utilized toward the end of the operation for the double purpose of ridding the body of possibly damaging amounts of the anesthetic and by complete aeration of the lungs provides prophylaxis against post-operative complications such as atelectasis (partial or massive collapse of the lung). This same procedure carried out at intervals post-anesthetic where respiratory disturbances exist, protects against possible later thrombotic or embolic accidents. Carbon dioxide and oxygen mixtures are used successfully to combat undue depression following the use of avertin, the barbiturates, or damaging effects of ether or chloroform. The percentage used for this work is, in adults, 10 per cent carbon dioxide and 90 per cent oxygen, with children 95 per cent oxygen and 5 per cent carbon dioxide.

The increasing use of carbon dioxide-oxygen in the latter (95 per cent oxygen plus 5 per cent carbon dioxide) mixture for resuscitation from poisonous gases, alcoholic depression and morphine poisoning, is now well established. The mixture of carbon dioxide 30 per cent and oxygen 70 per cent has been successfully used for hiccoughs, inhalations of short duration — 2 to 6 breaths — repeating at intervals as the paroxysms indicate. The well-known use of low percentage of carbon dioxide, 2—5 per cent, for resuscitation of the new-born need not be enlarged upon here.

Nitrous oxide is not a recent development but its adaptation as a supplementary aid in the modern use of synergists and basal anesthetics emphasizes its importance as perhaps the least damaging in its anesthetic action and certainly the safest in regard to explosibility. Nitrous oxide, a light anesthetic, requires supplementary aid of either increased premedication or combination with ether vapor. As an analgesic used with local anesthetic, in the opinion of many, it affords the greatest protection to the handicapped patient. It was on this belief and premise that Dr. Crile’s theory (anoci-association) was elaborated.

The acceptance and popularity of nitrous oxide-oxygen resulted in the perfecting of gas apparatus, including the auxiliary appliances necessary for intratracheal and intrapharyngeal methods, and later for use of
carbon dioxide and ethylene gases, in sequence or combination. With accumulation of experience and knowledge we have now a flexible control of this anesthetic and continuing use enhances its value. This perfected control furnished the necessary equipment, and with slight modifications the technique of administration, for the use of the newer gas, ethylene.

Ethylene (C2H4) — an anesthetic of the hydrocarbon olefine group, a lipoid solvent with action analogous to ether; lends itself to the same wide application as nitrous oxide, and, like it, must be administered with controlled percentages of oxygen. Ethylene occupies middle ground between nitrous oxide and ether, being more potent than the former and less potent and irritating than the latter. To Luckhard and Carter of The University of Chicago, the credit is due for enlarging upon early and meager experimental work done on this gas dating from 1849. In 1922, through their efforts, a successful demonstration of ethylene anesthesia was given at the Presbyterian Hospital, Chicago, Dr. Herb, anesthetist. Since this date ethylene has become well and favorably known. Ethylene mixed with certain percentages of oxygen is a highly explosive gas and it was an unfortunate thing that during its early use distressing explosions occurred, due to inadequate knowledge of its explosive range and preventive measures, necessary to avoid accidents. The handicap thus created has been difficult to overcome and it seems only fair to state that authoritative, present opinion is that “the relative explosive hazards of ethylene and ether, when mixed with air or oxygen, are practically equal.” We might add that all anesthetic mixtures containing ether and oxygen in certain combinations have inherent possibilities of explosion. The regulation of dosage to avoid, entering the now known explosive inducing range, should therefore be borne in mind.

The manufacture and purification of cyclopropane (C3H6) — a hydrocarbon gas — has been recently developed by Wardell, and the gas is now offered for anesthetic purposes. Reports given indicate that a satisfactory technique of administration has been worked out in different clinics, and increasing use will determine its place in the anesthetic list. It is an explosive gas, although said to be less so than ethylene.

The beginning of the use of local anesthetics for topical, regional and spinal use dates from the discovery of cocaine by Niemann in 1859, application of this discovery to general surgery (eye) by Koller in 1884 and its use as a spinal injection by Professor Bier, Tuffier, Jonnesco, and many others. Today its revival in more effective form is the result of much trial and effort and in this perfecting of technique, credit is due to Labat, Pitkin and other painstaking investigators.

Discussion of local anesthetics comes within the scope of this paper only to emphasize the use of certain drugs, such as sodium amytal and other barbituric compounds, administered the night before for the double purpose of giving the patient a good night’s sleep and insuring detoxication of the novocaine or spinocaine used. Ephedrine sulphate, gr. 3/4 (adult) given twenty minutes before the lumbar puncture, affords protection against a fall in blood pressure. It is non-toxic and can be repeated if the blood pressure falls after the injection, indication for its use being a drop of 20-30 m.m. reckoned from the patient’s original pressure.
The combination of gas analgesia with spinal or regional anesthesia in the psychically disturbed patient, and ability to supplement with inhalation anesthesia in cases where the local injection is unsuccessful or the anesthesia period insufficiently long for certain operations; are factors in giving more flexible control of this type of anesthetic. Pitkin emphasized the role of "psychic anesthetist" and rightly so, as the ability to keep the patient relaxed and comfortable mentally, by suggestion, is an art; useful alike in the induction stage of all anesthetics, but of paramount importance in types of anesthesia in which consciousness is not abolished. The taking and recording of blood pressure readings and keeping an accurate chart of the patient's reaction, is a necessary part of the administration technique.

Oxygen inhalation will successfully combat "the breathless feeling" and nausea some patients have shortly after a spinal injection. The giving of oxygen and carbon dioxide mixtures has successfully raised blood pressure 10-15 mm. and makes the patient more generally comfortable; inhalations of 3-5 minutes usually sufficient, can be repeated if necessary. However, in regard to control of blood pressure, ephedrine is decidedly the most effective agent.

Synergistic methods — a logical outgrowth of the use of premedication drugs, covers a wide range of past and present investigation, the influence of which cannot now be fully evaluated.

The use of synergizing combinations is based on the fact, as stated by Meyer and Gottlieb, "That if the weakening or prevention of the action of one drug by that of another be called antagonism, the one-sided or reciprocal augmentation of such action may be called synergism." The theory of synergism also seems to confirm Burg's law, that, "The sum of the combined action of one or more narcotics, administered simultaneously or shortly after each other, produces a much more prolonged effect than when the total equivalent quantity of either one narcotic had been administered alone. This increased action is particularly marked when the two narcotics have different cell receptors or belong to different chemical series, in which case the two drugs seem to potentiate each other and that a dose of any one drug acts much more markedly when given in frequent small doses than when administered at once in a single dose."

We now recognize two states of synergism — synergistic anesthesia, when unconsciousness is established — synergistic analgesia, when the subject is conscious but rendered indifferent to pain and is comfortable mentally.

The synergism of morphine-scopolamine, morphine-atropine, (in patients with a morphine intolerance, pantopon is substituted) used alone to control pain or used with general anesthetics to secure analgesia and anesthesia as desired, is well-known and widely applied; not so well-known is the synergistic action of magnesium sulphate. In 1914 Melzner demonstrated the anesthetic properties of this drug and defined its synergistic action as follows: "When after the administration of very small amounts of ether, insufficient to cause anesthesia, an inefficient amount of magnesium sulphate is injected intramuscularly, a profound anesthesia results which can be maintained for hours."
Gwathmey, following up Meltzer's work, carrying on investigations in regard to the synergistic action of magnesium sulphate and other agents, published in 1921 the result of his research and evolved the application of synergism and colonic ether to the production of analgesia and anesthesia.

Briefly stated, his contention is, that while magnesium sulphate used alone is an unsafe anesthetic, when used for its synergistic properties it is not only harmless but one of the most effective of known anesthetics. He states that morphine given with magnesium sulphate synergizes gas-oxygen, deepening the effect so that nitrous oxide may be cut down and the oxygen increased; used with ether it allows for a reduced amount of that drug, $\frac{1}{3}$ to $\frac{1}{2}$, with no decrease in the efficiency of the anesthetic. It is his belief that given with morphine it seems to act mechanically by holding it in contact with tissues longer than morphine alone is able to maintain such contact. For instance, $\frac{1}{4}$ gr. of morphine given in 2-4 c.c. of 25 per cent solution of chemically pure magnesium sulphate, is increased in value from 50-100 per cent as compared with the same amount of morphine given in sterile water.' One hypodermic of the same mixture (magnesium sulphate and morphine) will relieve pain from 10-30 hours compared to 2-4 hours when sterile water and morphine are used.'

Gwathmey emphasizes this value of magnesium sulphate to deepen the action and prolong the effect of morphine in its application to the post-operative comfort of the patient. He claims that the resulting prolongation of post-operative comfortable analgesia is a valuable factor in lessening the patient's discomfort, in regard to nausea, vomiting and gas pains and in minimizing surgical shock.

Importance is attached by him to the usefulness of this synergistic combination with colonic ether. This method, although as pictured by its adherents leaves little to be desired, has not taken the place of inhalation anesthesia in general surgery, but has its widest usefulness in obstetrical work.

In this particular field it is acknowledged that the formula and technique elaborated by Dr. Gwathmey and his co-workers is an important contribution. The last formula representing the end result of much investigation is:

**Formula:**

- Quinine alkaloid: gr. 20
- Alcohol: 40 minims
- Ether: 2½ oz.
- Petrolatum liquid or
- Olive oil: 4 oz.

**Technique:**

I. Three intramuscular injections of magnesium sulphate — each 2 c.c. of 50 per cent solution.

II. An injection of morphine sulphate gr. $\frac{1}{4}$ given with the first injection of magnesium sulphate only.

III. Rectal instillation of the above formula.

In the New York Lying-In Hospital, Gwathmey's method of colonic ether has been successfully used in a large series of cases. The opinion expressed is that it affords protection to both mother and child and is
acceptable and safe for use in all types of cases. While it seems logical that this formula representing such a great amount of research and practical work should be favorably considered, it is also true that there is a decided difference of opinion as to the entire safety of magnesium sulphate. Variations of this technique, to best suit the beliefs and need of different surgeons, therefore exist; in some cases modifying the dose of morphine or giving it in divided doses with scopolamine instead of magnesium sulphate; the use of inhalation anesthesia rather than colonic instillation, et cetera.

While indications for use of rectal ether-oil (in various accepted combinations) are broadly given; as the insane, neurotic patient, plastic and orthopedic surgery, its widest and most useful application is in obstetrics.

In evaluating this method of anesthesia, study of its contra-indications should engage our attention. It should not be used in patients with any history or evidence of rectal lesions, colitis or diabetes. Magnesium sulphate combinations used advisedly in kidney diseases. The greatest emphasis should be placed on the selection of precise technique which will afford protection against post-operative colitis or more serious complication of ulceration of the colon.

The introduction of barbital (veronal) by Fischer and Von Mering in 1904 was followed by its extensive use as a hypnotic, which led, later, to investigation and use of the barbituric compounds. Of this group amytal, or rather its sodium salt, is now used successfully as a hypnotic and basal anesthetic, and an almost voluminous amount of data is available for study. As all barbituric compounds possess with differing manifestations, the ability to produce hypnosis, and with increased dose basal anesthesia, a short analysis of sodium amytal may be helpful in evaluating the usefulness of other members of this group used for similar purposes.

Sodium amytal as stated, is used as a preliminary hypnotic or a basal anesthetic to general anesthetics, and is also used with spinal anesthesia. The method of administration is intravenously, orally or by rectal instillation with ether-oil, supplemented in the first two methods with any desired inhalation anesthetic, gas-oxygen usually preferred. The basis of dosage is 1/10 gr. per pound of body weight, but it is now generally conceded that the given amount should not exceed 9 to 12, or, at most, 15 grs. This is usually combined with 1/8 to 1/4 gr. of morphine, atropine 1/150 to 1/200 gr. given one-half to one hour before the patient goes to the operating room.

The intravenous method is said to afford better control of dosage as the injections can be stopped when the desired effect is obtained; the fluid must be given slowly, 1 to 2 c.c. per minute. There is apparently little difference between the two methods except in the case of oral administration it takes from 5 to 10 minutes longer for hypnosis to appear and a longer time for it to wear off. It is conceded that respiratory depression is more likely to occur when a full dose (9 to 12 grs.) is given orally at one time, and the usual practice now is to give the drug in divided doses, 1 capsule (grs. 1) every hour until the desired effect is obtained, up to one hour before operation. Lundby advises the use of the intravenous method when an amount over 10 grs. is given. He also ad-
vises that in infants the drug can be given in capsules by rectum, ½ gr. to a child under 1 year, 1 gr. to a child between 1-2 years and about 3 grs. for children 2-3 years. If the patient is old enough to swallow, oral administration is satisfactory.

Weighing the relative value of the intravenous over that of the oral method, it seems that the oral method, because of its more simple application and being extensively used, is largely superseding the intravenous method for routine work, the latter being used when special need indicates it, as giving more efficient control of a particular case.

The advantages of sodium amytal are a quiet induction with a lessening of psychic fear, prolonged post-operative sleep, lessened memory of painful post-operative events, nausea and vomiting usually absent. Detoxication of anesthetics, especially local anesthetics, is obtained.

Although sodium amytal can be used as indicated in general surgical work, it is chiefly useful in giving pre-anesthetic control of the nervous, neurotic patient. It is also considered by some authorities to be of great value as a pre-medication drug in patients suffering from Basedow's disease. Sodium amytal is acknowledged an efficient agent in obstetrical anesthesia, affording a longer duration of pain control — an important factor in this work. Its use in spinal and regional anesthesia has already been emphasized.

Lundy states the disadvantages as the possible fall in blood pressure, cyanosis and shallow breathing, in some patients marked delirium, edema of the lungs due to shallow breathing and the inability of the patient to raise mucus after such operations as thyroidectomies and tonsillectomies. These damaging effects are more likely to occur when a higher dose is given (20-30 grs.). Wider use of the drug has demonstrated the danger of higher dosage, and these untoward effects are now rarely seen.

Nursing care post-anesthesia is emphasized particularly in regard to prevention of respiratory obstruction from the falling back of the tongue. The patient should be kept on one side so the tongue will fall forward and an airway inserted if necessary. Due to prolonged sleep, care should be exercised in the use of hot water bags, and gentle restraint used to take care of varying degrees of mental disturbance, which may occur.

Sodium amytal is considered a valuable drug for non-surgical cases by Lundy and others. In smaller doses it is a valuable hypnotic, used with benefit in psycho-neurotic cases, helpful in insomnia, giving restful sleep and used widely and efficiently in the control of post-operative psychosis. It is judged less dangerous and more efficient than other agents formerly used, in controlling the intractable pain of burns and injuries. It is used in tetanus to bring the patient under control so that serum and antitoxin can be given. In the case of gastric crises, with vomiting, sodium amytal, given intravenously, lessened pain and controlled vomiting for several hours at a time. In severe hiccoughs the spasms uncontrolled with oxygen and carbon dioxide alone, yielded to the use of sodium amytal followed by inhalation of gas mixture. Insane patients, uncooperative, nervous and excitable, given small doses of sodium amytal, 5-9 grs., were rendered cooperative, for the extraction of teeth. The drug seems to allay the intense discomfort of pruritus.
In 1930, Lundy writing of sodium amytyl also mentions using sodium nembutal (pentobarbital) as a hypnotic and basal anesthetic. In 1931 Barlow and his co-workers (Western Reserve University, Cleveland), with the hope of definitely determining the usefulness of barbiturates conducted an investigation of all those included in the pharmacopeia or of recognized usefulness by other investigators. The result of this research has proved of great value in establishing the pre-medication efficiency of different barbituric compounds. "Barlow's grouping of these drugs, as to 'pre-medication efficiency (high to low) judged by the ratio of effective to lethal dosage, the minimal duration of hypnosis to complete recovery, and fewest disagreeable side effects' is as follows: Pentobarbital, Avertin, Dial, Allonal, Neonal, Phanodorn, Amytal, Luminal, Barbital (veronal), Pernocton." (Avertin included in this series is not a barbituric compound.)

Barlow emphasizes pentobarbital, as the safest and most efficient of the group. Recent publication of the clinical experience in the use of this drug, on the surgical service of the University Hospitals of Cleveland, confirms this favorable opinion.

In evaluating the barbituric compounds, in relation to anesthetic efficiency, it is now conceded that while certain of the group are of value for surgical work, the usefulness of others is chiefly that of sedatives and hypnotics. All investigators stress the fact that safety lies in the use of barbiturates as basal anesthetics only, supplementing local or inhalation drugs to produce surgical anesthesia. As the modern trend of anesthetic procedure is towards securing comfortable analgesia, or amnesia, to the patient, it seems reasonable to expect that further research will result in making available still more acceptable barbituric compounds.

Triethylmethyl alcohol, known in this country under the trade name of "Avertin," was first produced by two German research workers, Duisberg and Willstaetter. The drug used successfully in Germany (1926), as an anesthetic was introduced into United States several years later; since which time it has taken a prominent place, as a basal anesthetic.

In form the drug is a white crystalline salt, easily dissolved in distilled water at a certain temperature (40 C.). In higher doses it acts as a basal anesthetic, in lower doses as an hypnotic. Avertin is changed chemically in the body, being detoxified in the liver, through union with gluronic acid, and is excreted mainly through the kidneys.

As stated, the drug is a proprietary medicine put out as "avertin fluid," a solution of aver tin in amylene hydrate and with it is supplied a vial of Congo red test solution and a dropper. The book of instructions which comes with each package contains plain, explicit rules for its administration; together with a series of dosage tables worked out on the basis of milligrams per kilogram of body weight, with calculated amounts of distilled water to form a two and one-half per cent solution.

"A dosage chart computed on the basis of body surface area" worked out in the department of surgery of the Yale University School of Medicine, has been recently "presented as a safer method for determining the dosage of aver tin, for the individual patient, especially in reference to patients of relatively good health, but of abnormal weight."
While the method of using avertin is simple, a rectal injection, particular care should be exercised both in determining the correct dose for the individual patient and in preparing the solution. If the solution is heated above 40° C. decomposition occurs, hydrobromic acid is split off and dibromacetalddehyde is formed which causes marked irritation of the intestinal mucous membrane, with possible resulting colitis a more serious ulceration of the colon. To safeguard against this, just before injection a small amount of the solution is tested with congo red aqueous test-solution — and a pure orange red color should develop. If the color becomes blue or violet (indicating impurities) the solution is discarded. For purposes of safety it is a wise practice to have the preparation checked by two anesthetists, and the one who administers the drug be required to return the test solution for further checking.

The simplicity of administration must not mislead us as to the importance of selecting the dosage, affording the greatest protection to the individual patient. It seems apparent that the mass of avertin is absorbed quicker than the water in which it is dissolved and once the injection is given the action depends on the natural disintegration of the substance in the body, this in turn depending on the acid-alkali state and intensity of body metabolism. It is probable that older patients reach the state of anesthesia with smaller doses; younger patients with more intensified metabolism require larger doses; and children, because of active metabolism, seem to tolerate the largest dose of all. The over-weight patient should be underdosed. This rule also applies to patients with large abdominal tumor or ascites.

The rectal injection, thus carefully determined, prepared and checked, is given 25-30 minutes before the operation, preferably with the patient in bed. Adult patients are usually given morphine gr. 1/4 and atropine 1/300 five minutes before the injection, in the ordinary patient. In the psychically disturbed patient when it seems wise to disguise the procedure as an enema, the hypodermic is given when unconsciousness occurs, usually 4-8 minutes after the injection. Blood pressure is taken before the injection, and at regular intervals thereafter.

After injection unconsciousness occurs quickly and quietly. Blood pressure usually falls 10 to 30 m.m. If relaxation of the jaw and tongue occur an airway is inserted. Patient is removed to the operating room and prepared for the operation. If the depth of anesthesia is insufficient, evidenced by reflex movement during surgical hurt, supplementary gas-oxygen anesthesia is used. In our experience light gas-oxygen anesthesia, practicing rebreathing, corrects the lowered blood pressure and gives efficient control of respiration. If any untoward depression or cyanosis occur before the patient is removed to the operating room an inhalation of oxygen with 5 per cent carbon dioxide or a few whiffs of ether will usually correct the condition. If this is not successful and the condition seems serious the use of ephedrine 1/4 gr. for the adult, or caffein-sodium-benzoate grs. 7/10 are used. Killian advises the use of alpha-lobelin grs. 1/20 for child, 1/20 grs. for adult, given intramuscularly in cases of severe respiratory depression. In our experience oxygen and carbon dioxide have been sufficient. Almost invariably with the institution of light gas anesthesia, the blood pressure returns quickly to the normal level.
Avertin's greatest value is reducing the psychic distress of nervous patients and frightened children. The ease and quickness of falling asleep has already been mentioned. Surgical anesthesia is maintained with lower concentrations of gases — if ether is necessary for deeper relaxation, smaller amounts are used. Post-operative, the prolonging of the quiet period is a favorable feature, lessening nervous shock and blurring the memory of pain provoking procedures; nausea and vomiting lessened. Avertin is not irritating to lung epithelium, causing no hypersecretion of mucus; it therefore should protect against pneumonia, and it is our impression that this is so.

Avertin as a basal anesthetic has a wide application, and is used for practically every type of surgical procedure — from major operations to control of patients during painful dressings. The selection of the supplementary anesthetic (local or general) and its method of administration, depends on the nature of the operation, and the choice of the individual surgeon.

Avertin is of particular value in neurological surgery, on account of the quiet breathing induced and non-interference with intra-cranial pressure; important factors in securing comfortable control in difficult cerebellar tumor operations. For operations on the nose, face and neck, it gives a better field for the surgeon. A word of warning, in throat operations is the post-operative danger of blood getting into the trachea, and causing asphyxiation, due to the patient's inability to expel the fluid. In thoracic surgery where it is desirable to have the cough reflex retained the drug is given advisedly. In orthopedic surgery it is extensively used and liked. In thyroid work, avertin given, disguised as an enema, makes the technique of "stealing the gland" much more simple.

Avertin, alone or supplemented with nitrous-oxide-oxygen, allowing no ether in the apparatus, is particularly indicated in operations necessitating the use of the cautery or diathermy. If ether is necessary, an element of explosive danger is introduced, and spinal anesthesia affords the best protection.

The contra-indications for the use of any except guarded doses — that is not above 80 milligrams and lower as deemed advisable are: patients suffering from dehydration, anemia, impairment of the renal function, heart defects with a tendency to, or already established, low blood pressure and negroes because of lessened tolerance.

Direct contra-indications to its use are broadly given as patients suffering from severe blood diseases, organic diseases of the liver, rectal lesions, bilateral diseases of the kidneys, advanced tuberculosis. In children its use is contra-indicated in severe nutritional diseases, heart lesions, and whooping cough, with asphyxial paroxysms (inability to expel mucus a factor of danger).

The use of avertin in non-surgical cases will doubtless be extended in the future. At present favorable reports are given in regard to efficient control of convulsive seizures in tetanus, and eclampsia. In the agitation states of Basedow's disease (non-surgical) the drug has proved helpful in combating motor unrest. In psychiatry avertin is of great value in controlling severe paroxysms.
As avertin is apparently non-irritating to the intestinal mucous membrane, and is not accumulative in effect, injections can be repeated, 8-10 hours or oftener, according to the duration of sleep, as indicated for control of the patient.

**SUMMARY**

While realizing that any attempt at an evaluating summary would on account of the mass of material involved, be inadequate, the following conclusion may prove interesting.

1. Broadly, the greatest recent advance in anesthesia has come about through research, as to the nature and application of premedication drugs and basal anesthetics — avertin being considered by many to be the most important later event in anesthesia.

2. The perfecting of gas-oxygen apparatus, in which connection emphasis should be placed on the elaborating of carbon dioxide filtration; a method affording almost precise control of respiration, and greatly lessening the amount of anesthetic gases. More efficient apparatus for giving ether.

3. The wider application of local anesthetics and development of more efficient technique in their use. In this connection the role of the nurse anesthetist, in keeping the patient comfortable, taking blood pressure, et cetera, is emphasized.

4. Increasing perfection of methods of administration, combining premedication drugs with inhalation anesthetics, and a wider variety of methods for their use; thus steadily evolving a more flexible control of patients under anesthesia — this is a great step forward.

5. A constantly growing realization, by the laity, that anesthesia can be comfortable as well as safe, has established a feeling of confidence, the beneficial effect of which can hardly be evaluated. The ability to give patients post-operative rest, with mental blurring of pain, lessens nervous shock and makes convalescence more comfortable.

6. More scientific control of modifying and protecting factors in anesthesia; such as: preanesthetic preparation, psychic control, comfortable position on the table, control of humidity and temperature of the operating room, precise means to combat shock from any cause, et cetera.

7. Knowledge of the explosive range of certain combustible anesthetic mixtures, and utilization of safety measures to insure against possible accident.

8. Advancement in regard to more informative anesthetic charts. The correct filing of data, so that research may be carried on in conjunction with clinical facts. Wider dissemination of knowledge on the subject, through medical journals and special publications.

9. The event of two new general anesthetics, divinyl ether and cyclopropane gas. Inadequate knowledge of their use makes impossible any prediction as to future place.

10. A general raising of educational standards, and definite recognition of anesthesia as specialized service. Our chief concern is now and always shall be to afford such education and experience to the nurse anesthetist as will enable her to skilfully carry out any desired anesthetic procedure, and correctly interpret the behavior of the patient under anes-
thesis. This in the final analysis means ability, not only to keep the patient in the zone of anesthesia as best insures the safe accomplishment of the required operation, but implies, in case of need, knowledge and quick application of such remedial measures as will secure anesthetic safety to the patient.

In evaluating available literature on anesthesia we will as a well-intentioned, progressive group, have a deep appreciation of those who have made such fine contributions, and resolve to take a more active part as contributors to the sum total of useful information in this important subject. A department of education, which we hope to establish within our "National Association," will afford means of facilitating this essential work.

In these days of changing drugs and methods — many so glowingly set forth by enthusiasts — as nurse anesthetists we will be wise indeed to heed, in moderation, the words of the wise old saw:

"Be not the first by whom the new is tried,
Nor yet the last to lay the old aside."

Mrs. Mae B. Cameron
Honored

Mrs. Mae B. Cameron was the guest of honor at a gathering in the Marine Ballroom of the Edgewater Beach Hotel, Chicago, on the evening of May 1st, 1935. It was attended by two hundred of her friends and associates.

The party was planned to afford an opportunity to celebrate the completion of Mrs. Cameron's twenty-five years of service to Ravenswood Hospital, and to anesthesia.

A platinum watch set with thirty-two diamonds, was presented by the Hospital Staff as a token of gratitude and appreciation; also a testimonial from the Medical Staff and Hospital Directors in appreciation of her loyalty and faithful service to humanity.

Mrs. Cameron's interest in the National Association of Nurse Anesthetists has been outstanding, greatly to the benefit of the organization, enriched by her encouragement and

and many are the lives she has friendship.