utes. Yandell Henderson's [10] conclusions as to the respiratory stimulation of carbon dioxide and the explanation of deaths from cardiac failure due to apnea from excessive ventilation of the lungs, justifies this method, as does also the closed gas-ether sequence of Dr. Bennett.

The other type such as the Teter and the Monovalve are constructed on the same principle except that there is a constant flow of the gases in a definite proportion and less rebreathing. The Monovalve has the advantage of a finer adjustment of pressure, the substitution of electric heating for alcohol, and the evaporation of ether by dropping on a heated surface, thus enabling the anesthetist to increase the depth of narcosis very quickly.

The objection to complicated apparatus must in this case give way to the necessity of having a mixture of gases delivered under a definite pressure through an air excluding mask. It is at best a difficult anesthetic to administer and correct apparatus is absolutely necessary.

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THE CHOICE OF AN ANESTHETIC.*

By CAROLINE B. PALMER, M. D., San Francisco.

I am somewhat painfully aware of my rashness in attempting to speak on a question which has caused such frequent controversy as the choice of anesthetics. In reading the literature, and in listening to discussions on this subject, one is unavoidably struck by the partisan spirit frequently displayed. It is sometimes more as if politics or religion were being considered than a question of therapeutics.

Fortunately in the past few years much valuable experimental work has been done, giving us something more definite as a guide than the simple opinions which are expressed with such amazing frequency. These experiments seem to have proved beyond reasonable doubt that the three most commonly used anesthetics, viz: nitrous oxide with oxygen, ether and chloroform, rank in toxicity, in immediate danger, and in dangerous after effects in the order named. That is, nitrous oxide with oxygen, properly administered, is remarkably free from danger during anesthesia, and that it causes no after effects of any significance: that ether may cause death either from failure of respiration or even primary heart failure at time of anesthesia, but that in ordinary cases the danger is slight, except when the administration is extremely faulty: that it causes slight anemia, marked decrease of coagulation time of the blood, marked decrease in phagocytic power and may be followed by lung and kidney complications, and probably in certain cases by acidosis: that chloroform is more dangerous to administer, as it occasionally proves fatal even in the hands of careful and expert anesthetists and when given under the most favorable conditions as to preparation of the patient, posture during anesthesia, etc. In Hewitt's work on anesthetics he reports, in a summary of over 1,000,000 anesthesias, immediate death from chloroform as one in 3000, and from ether as one in 16,000 administrations. It is held by the best authorities that in giving chloroform, a vapor strength of more than 2% is not justifiable, and in practice it is difficult to estimate this per cent. accurately. When an apparatus is used controlling the administration so that no more than 2% can be given, it is sometimes difficult to induce anesthesia.

The after effects are quite as numerous and more serious than those following ether. It produces hemolysis, distinct anemia, marked decrease of phagocytic power, marked decrease of coagulation time, and the condition known as late chloroform poisoning adds materially to the mortality after the use of this anesthetic.

Excluding nitrous oxide and oxygen, as that is the subject of a separate paper this evening, the choice of anesthetics from the standpoint of safety seems to be overwhelmingly in favor of ether and, as a matter of fact, ether is the routine anesthetic in most of the larger hospitals in our country. It is in small hospitals, in offices and in emergency cases that chloroform is most frequently given in the United States, and this is doubtless one of the reasons for the relatively high mortality attending its use, as, under such circumstances, the same care is not always exercised as to preparation of the patient, posture during anesthesia, and skill of administration as is becoming routine in most of our hospitals.

PREPARATION.

The question of preparation has a most important bearing upon the choice of anesthetics. If, for any reason, a patient who has not had the usual preparation must be anesthetized, the choice of anesthetic, from the standpoint of safety, should be nitrous oxide and oxygen. In case this is not available, or should greater relaxation be required, ether becomes the second choice, but in the light of statistics it would seem that no one would care to take the added risk of using chloroform under such circumstances.

POSTURE.

The posture required for a given operation is sometimes the controlling factor in the choice of anesthetic. A semi-upright posture is practically free from danger when nitrous oxide is used. It is usually not attended by any serious danger when ether is the anesthetic, but, as far as I know, all competent authorities condemn it for the administration of chloroform, and yet we still have fatalities in dental chairs from chloroform, frequently administered by graduates of medicine. The following is a quotation from an article by a dentist, published in the *American Medical Association Journal:* "The record of deaths in dental chairs

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from chloroform is so appalling that one would think no intelligent dental surgeon would permit this agent to be used in his office, even though a physician should recommend it and assume the responsibility." The implication here is rather hard on physicians, but I am afraid that we cannot consider it very unjust. Francis R. Packard reports a list of deaths from anesthesia in tonsil and adenoid operations. Of 29 deaths, 26 were attributed to chloroform, 2 to ethyl chlorid, and 1 to A. C. E. mixture. The question of posture doubtless was a factor in many of these cases. He does not mention any deaths from ether for this operation, but numbers have been reported from various sources. Quoting from an article in a recent number of the *A. M. A. Journal*—"It has been generally believed that the presence of the so-called status lymphaticus was the cause of the rather unusually large proportion of cases of death during anesthesia, which occurred in the course of operations for the removal of tonsils and adenoids. Henderson explains these deaths by saying that they are due, not to status lymphaticus, but to the acapnia which accompanies the deep respiratory efforts incidental to the intermittency in anesthesia, which often prevails in these cases, to too light anesthesia at the start and to nervousness preceding."

The choice of anesthetic for infants is still influenced to an extent by the old time opinion that chloroform is safe for children, whatever may be said of it for adults. I have searched diligently for justification for this belief but without avail. Infants take chloroform readily and that is, I believe, all that can be said in its favor. Why, when its poisonous effects upon adults, upon dogs, cats, rabbits, etc., are so freely admitted, should the human infant be thought to be immune! In my own experience I have never given chloroform to a very young child, that I have not been satisfied it would have been better under ether. This is the only subject in the whole field of anesthesia in which I plead guilty to the partisan spirit before mentioned.

ANESTHETIC SEQUENCES.

Much has been said recently for and against the various anesthetic sequences. The nitrous oxide-ether sequence has been condemned by certain authorities on the ground that the "oxygen starvation and carbon dioxide poisoning so induced cannot but be harmful." As the nitrous oxide is usually given for only about one minute preceding the ether, it is difficult to believe that there are sufficient grounds for such a statement. On a basis of 14,000 administrations in three hospitals in San Francisco, the advantages seem very great, and, in comparison with those cases in which ether alone has been used, are as follows: The induction period is reduced by about one-half: anesthesia is induced with a minimum of discomfort to the patient: the so-called stage of excitement is but little in evidence, and the amount of ether required is somewhat decreased. As the stage of excitement is admitted by all authorities to be the period of greatest danger to life from any anesthetic, this alone would seem to be sufficient reason for the routine use of nitrous oxide as preliminary to ether.

The use of chloroform as an introduction to ether is a different story, for, while it possesses to quite an extent the advantages of nitrous oxide, when so used, it has the great disadvantage of being especially dangerous to life during the induction period, while nitrous oxide is remarkable for its freedom from danger.

MEDICATION PRECEDING ANESTHESIA.

The use of a hypodermic injection of morphine and atropine is recommended by competent authorities, and condemned by equally competent authorities. The objections urged are, that as one drug may augment the action of another, an overdose is more easily administered: that in case of accident there is not only the anesthetic to be eliminated, but the more permanent drugs as well: that the pupillary reaction is masked: that morphine allays the reflex excitability of the upper air passages, retards coughing, therefore favoring the retention of secretions or vomitus in the trachea so predisposing to pneumonia, and that morphine causes nausea in some patients. The advantages mentioned are: That the patient comes to the anesthetic room in a more quiet frame of mind, fear being decreased or absent, and with it one of the greatest factors in producing shock: that the secretions are decreased, rendering the air passages comparatively free, therefore reducing the dangers of pneumonia: atropine prevents reflex stimuli coming through the superior laryngeal nerve or its branches from causing a sudden inhibitory stoppage of the heart, and is a vasomotor stimulant: less anesthetic required, and in most cases both morphine and atropine tend to reduce nausea. Comparing these reasons for and against the use of a preliminary hypodermic injection in the light of 5000 administrations of ether in my own experience, in which a carefully regulated dose of morphine and atropine has been given in practically all cases, except children under five years and the very aged, the advantages seem to more than offset the disadvantages. All of the objections urged, however, may become very real if an overdose has been administered, and, for this reason, and because the use of the hypodermic is a part of the anesthetic, I believe that when used the exact dose should be indicated by the anesthetist.

WARMING OF ETHER VAPOR.

The warming of ether vapor has received considerable attention of late, and seems to be valuable. The possibility suggests itself that one reason for our better results under the drop method of giving ether over the old cone method may be that the smaller air and vapor space allows a certain amount of warming of the vapor, and that this with the continuous instead of intermittent administration, as by the cone method, may be the real advantage instead of the much talked of increase in the amount of air. It seems quite possible that there may not be such an increase in

the amount of air as some of us have thought, for certainly most anesthetists keep the gauze or small inhaler at least partly covered much of the time, and the result of experiments upon the value of a certain amount of rebreathing indicate that this is rather an advantage than the reverse.

For some time I have been experimenting with the warming of ether vapor, especially in operations on the face and throat where an inhaler cannot be used and the ether vapor is given through a tube, and I wish to show you a home-made apparatus which I am now using for that purpose. I do not claim anything original in this apparatus. It consists essentially of the bottle in which ether is vaporized and a cylinder of compressed air to obviate the necessity of using a hand or foot bellows. From this bottle the vapor is passed through a second one which contains warm water, and in its passage through this it becomes sufficiently warmed. The second cylinder is oxygen and is not a necessary part of the apparatus but simply a matter of convenience for use in cases where the addition of a little oxygen is indicated.

MISHAPS IN TREATMENT.

By DOUGLASS W. MONTGOMERY, M. D., San Francisco.

The therapeutic art is one acquired through long and painful experience, and can by no means be learned off-hand from books. The value of books in learning it is, however, indispensable, but statements in them must be compared with actual experience in order to make the knowledge fruitful.

Medicaments do not alone act differently in different individuals, but they act differently at different times in the same individual. A remedy that during the height of an eczema, where soothing applications are indicated, might be too weak, might be altogether too strong to use on a chronic eczema, where strong stimulating applications are needed. In addition to this there is the relative sensitiveness of the different regions of the cutaneous surface. Nowhere is this principle of fitting the remedy to the case so well seen as in inflammatory affections of the lower third of the leg in those whose circulation is none of the best. An indolent eczema in this situation that appears to need stimulation may be stirred up to destructive ulcerating activity if stimulating remedies are applied. The scrotum is another locality so sensitive that strong remedies may act on it in a highly disagreeable manner.

One evening I was called to see a young druggist, who, having a slight attack of poison oak, conceived the idea of treating himself. On looking into the matter he found menthol recommended as a good remedy for itching, and itchiness of the scrotum was exactly what he was suffering from. He thereupon made himself a fairly strong menthol preparation, which, on being applied burned atrociously. Now his chemical knowledge came to his aid, as he knew chloroform to be a fine solvent for menthol, and what better means could be devised for removing the tormenting stuff than to douse the scrotum with it. This was indeed liquid fire, and in itself would have constituted a very painful momentary experience, but unfortunately the menthol was already there to lend persistency to the torment. As is its nature the scrotum shrivelled up with the pain, and retained the menthol in the depths of its folds. All efforts to get the drug out or to wash it off only made matters worse. The patient grew frantic and hastened home. His pain accompanied him, however, and when I reached him his neurons were dancing with hysteria, with pain and with exquisite distress. Among other afflictions he had become persuaded he would lose his scrotum and testicles. While getting his story I really was busy turning over in my mind how to meet the therapeutic indications. It, of course, was of no use to try to wash or to wipe off the menthol. The contracted scrotum, as hard and rugose as a peach stone, would not permit of it. Happily I thought of bland heat, and ordered a starch poultice. The gentle heat would cause the muscles in the scrotum to relax, and the starch would soak up and dilute the menthol. I therefore ordered some hot water, which I poured on ordinary laundry starch to make a paste, and applied it. In a few moments the blessings of peace descended on that household.

The late Dr. W. E. Taylor used to say that the doctor who would apply either tincture of iodine or chloform to the scrotum ought to be crucified. Such applications are made, however, and I myself was once guilty.

At the opening of my career and while house surgeon in Chambers St. Hospital in New York, I was called to see a man suffering from gonorrheic epididymitis. As a bartender he had to stand all day, and so suffered both from the weight and from the tenderness of the diseased organ. To relieve him I decided to prescribe a linament to apply on flannel, and to wear in a suspensory bandage. The linament ordered was found in one of those students' manuals that contain so much concentrated, undigested knowledge, and consisted of equal parts of chloroform, tincture of belladonna, tincture of aconite and glycerine. The preparation was excellent in itself, but was accompanied by little or no explanation of its properties or uses. The man got the linament and the piece of flannel. I can see him yet as he applied the medicament. The scene lay in a rather large, sparely furnished room up on the West side in New York. The patient was seated well forward in his chair so as to suspend the affected member, and allow him the more readily to apply the flannel soaked with the linament, and he had the intent, preoccupied look incident to such occupations. The moment the application touched the scrotum he gave a roar, and if he did not reach the opposite corner of the room in one jump, he did in two. Tertullian thought that after death we shall travel from star to star; Victor Hugo in commenting on this said we shall then be stellar grasshoppers. My patient made an excellent initiatory attempt in preparing for the celestial job. While jumping about he emitted such a stimulating collation of vowels and consonants as I have rarely had served up before me. In