of the changes occurring in disease. There are no doubt other factors, such as emotional excitement, nervous disturbances, changes of temperature, etc., which affect the percentage of sugar in the blood, but these are probably of comparatively minor importance under normal conditions, and a discussion of their mode of action would not have a material bearing on the subject we are considering, or affect the general principles of the scheme we have outlined.

In conclusion, we wish to express our thanks to Professor Starling for permission to carry out the animal experiments described in his department at University College.

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ANAESTHESIA FOR NOSE, THROAT, AND ABDOMINAL SURGERY BY THE NITROUS OXIDE-OXYGEN-C.E. COMBINATION.*

BY

H. EDMUND G. BOYLE, O.B.E., M.R.C.S., L.R.C.P.,
ANAESTHETIST AND LECTURER ON ANAESTHETICS,
ST. BARTHOLOMEW'S HOSPITAL.

In the study of anaesthesia there can be no better or surer way of improving our knowledge than by conferences such as this. Here are gathered together anaesthetists from every quarter of this great continent, all ready and willing to share their knowledge with their fellows for the benefit of mankind in general and anaesthetics in particular.

As regards the administration of nitrous oxide-oxygen-chloroform ether combination for nose, throat, and abdominal surgery, let me begin by saying that I think the two great essentials for an anaesthetist to keep in his mind are (1) the safety and comfort of the patient, and (2) the comfort and convenience of the operator. If we take the first, and most important, I think that in a great many cases safety depends on the knowledge the anaesthetist has of some given method. By this I mean that it is safer for a man to use a method he knows rather than to use another method which in itself is safer but of which he has no knowledge.

When considering this question of safety and comfort of the patient we must include the pre-operative, operative, and post-operative periods. Take the pre-operative time; this includes the preparation before operation, etc. In my opinion there is no need for the drastic treatment that used to be meted out prior to operation; there is no need for that starvation and severe purgation that were in vogue years ago. The patient should be on a light diet and should be given an ordinary laxative. We must remember that any operation entails a certain amount of strain on the patient; it calls for an effort on his part, and he should not be enfeebled by starvation, purgation, and enemata. Of course there are a certain number of cases when it is essential to have the bowel clear, and naturally one does not include these in the above statement.

Pre-operative medication has done much to rob operations of their terrors, and if the patient is given hypodermically some morphine and atropine, or morphine, atropine, and scopolamine, before the operation, he usually comes to the table in a drowsy state with his mind somewhat dulled—a great gain on the condition of years ago, apart entirely from the fact that less anaesthetic is usually needed.

During the last four years I have been endeavouring to find some anaesthetic or mixture of anaesthetics which could be used in combination with gas and oxygen as an adjuvant to produce relaxation when necessary, and in

nose and throat work to assist in the maintenance of anaesthesia. I have tried a great many mixtures, and until the introduction of ethanestal recently by Dr. Mackenzie Wallis and Dr. Hewer, I was using as my adjuvant a mixture of chloroform and ether of equal parts. Now I have substituted ethanestal for ether, and I find that the chloroform is only needed for nose and throat work and in some of the abdominal cases. The aim of all who have been working on this matter has been to produce a form of anaesthesia not only safe and pleasant for the patient and adequate for the surgeon's needs, but also as little toxic as possible.

The after-condition of a patient who has been operated on under gas and oxygen anaesthesia ought to be, and is in practice, far better than when ether or chloroform has been given, for since the nitrous oxide and oxygen is non-toxic and quickly eliminated, the patient returns to a normal state far more readily than after the more potent and toxic drugs. After an ether or chloroform administration it takes some time for the drug to be eliminated from the system, and this process of elimination must add to the strain on the patient. The actual technique of the administration is quite simple and the necessary skill is readily acquired.

In 1917, when I read a paper on gas and oxygen with regulated rebreathing in military surgery, I had not then had much opportunity for using this anaesthetic in civil work, but since then I have been using it for a great variety of cases. In 1917 I thought that gas and oxygen was not well suited to abdominal work; I have been trying to form a combination of anaesthetics which would give me adequate relaxation and yet would use the minimum of toxic substances. At the moment I am using as my relaxant a mixture of chloroform and ethanestal of equal parts, so that the anaesthetic becomes a combination of nitrous oxide-oxygen-ethanestal-chloroform, and with this I have been producing a type of anaesthesia which entails but little strain on the patient, and is wholly adequate for the surgeon's needs. The actual technique I employ now is as follows:

The patient is given morphine, atropine, and scopolamine half an hour before the operation. Gas and oxygen is then given in the proportion of about 1 of oxygen to 10 of gas, and as soon as the breathing begins to get deep and regular the gases are allowed to pass over the surface of a mixture of chloroform and ethanestal (equal parts), so that they pick up a small amount of mixture. In a few minutes the breathing becomes automatic, with slight soft stertor, thus showing that anaesthesia has been obtained. The tap on the mixture bottle is then turned back, so that the patient is only having gas and oxygen, and the operation is started. The amounts of gas and oxygen must now be regulated to what the administrator thinks will be the correct amount, and this for the majority of cases is about 1 to 4 (or 1 of oxygen to 4 of gas). For a great number of operations it is quite unnecessary to give any more mixture, and the remainder of the operation is conducted under gas and oxygen.

Given in this way, the anaesthesia is excellent both for patient and operator, whilst the after-condition is extremely satisfactory. The patients readily regain consciousness and are not usually inconvenienced by nausea or vomiting. In addition to this is the fact that they are hardly, if ever, conscious that they have had anything save gas and oxygen, for they do not, as a rule, have any taste or smell of ethanestal or chloroform. This lack of smell and taste of ethanestal and chloroform carries another point worth bearing in mind: Those working in the theatre—surgeons, anaesthetist, nurses, etc.—do not become impregnated with the smell and odour of ether or chloroform—an important point for their own comfort.

I find nowadays in using this method that after a long afternoon in a theatre I can leave feeling quite fresh and well, and the atmosphere of the theatre never becomes laden with the vapour of ether and chloroform as it often did formerly. The small amount of ethanestal or mixture that one needs with this method is sometimes astonishing to those who are unfamiliar with it, for it is quite usual for only a drachm to a drachm and a half to be used during a long operation like, say, the removal of a breast.

Operations such as amputation of the breast, hernias, varicoceles, and the like, are quite easily done under gas and oxygen, and a very small quantity of either ethanestal or mixture; it is when one comes to the abdominal and nose and throat work that the difficulty begins. For some time now many of us have been trying to get some combination to act as a really good relaxant for abdominal

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work. Gwathmey of New York uses a combination of ethyl chloride, ether, and chloroform, while McKesson of Toledo recommends a saturation of nitrous oxide. Personally I have not tried this method up to the present, and I have preferred to rely on my mixture of equal parts of ether and chloroform, but I hope before returning to London to have an opportunity of seeing Dr. McKesson use this method. I have been using this mixture for the last two years, and have only substituted ethanesal for ether during the last three months, with, I think, a great improvement, not only in the anaesthesia but also in the after-effect, and I am only now beginning to realize what a good relaxation I can obtain, and how easily it is to produce almost at will, and within a few minutes.

Now, turning to the use of this combination in nose and throat work, when I first began to use this method I had nothing to guide me; so far as I knew, my friend Gwathmey of New York was the only man who had tried to give gas and oxygen for throat work, and he had only begun, for the war cut short his work in New York and he came over to Europe. Our technique is, briefly, as follows:

Hypodermic injections (in children, none or at most 1/200 gr. atropine; in adolescents, morphine 1/6 gr. and atropine 1/150 gr.; in adults, hyoscine, morphine and atropine, in Burroughs Wellcome's hyoscine compound "A" or "B") are given half an hour before the time of operation. The patient is then anaesthetized with gas and oxygen, and the anaesthesia deepened with ether or mixture until the breathing is deep, regular and slightly stertorous; the colour should always be pink. The face-piece is then removed, a gag placed in the mouth for those cases—for instance, enucleation of tonsil—when it is necessary, and the anaesthetic is continued by means of a tube placed in the mouth. Let me hasten to say that one of the astonishing things about this method is the small amount of mixture that is necessary to maintain the requisite anaesthesia. Indeed, in a certain proportion of cases hardly any mixture at all is necessary for the rest of the operation—that is to say, after the face-piece has been removed; after that, as I have said, in a certain proportion of the cases gas and oxygen alone is sufficient.

In this connexion I must mention one particular type of case in which I have been forced to use chloroform alone as my adjuvant. I refer to cases of diathermy. In our throat department Mr. Harmer is treating cases of carcinoma of the tongue, fauces, etc., with the diathermy cautery, and, I gather, with excellent results. Occasionally in these cases there is a certain amount of sparking—either accidental or intentional—and so one cannot have any ether in the adjuvant bottle lest there be an explosion, so that one has to use chloroform. In a large number of these cases the best way to continue the anaesthesia is to pass one or two small rubber tubes through the nostrils and lead the anaesthetic into the post-nasal or endopharyngeal space, and I do this by means of a metal stirrup and tubes. A still further development of this method has become necessary when dealing with certain plastic operations on the face and with such cases as laryngo-fissure and the like.

The first occasion on which I used endotracheal gas and oxygen was on October 9th, 1918, for a case of laryngo-fissure. In this case, after the tracheotomy was performed, I gave gas and oxygen by means of a small catheter through the tracheotomy tube, and with excellent result. Since then I have resorted to endotracheal gas and oxygen on many occasions for similar operations and for plastic face operations.

THE VALUE OF SPINAL ANAESTHESIA FOR URGENCY OPERATIONS IN THE AGED.

BY

A. H. SOUTHAM, M.A., M.Ch.Oxon., F.R.C.S.Eng.,
SURGICAL REGISTRAR, MANCHESTER ROYAL INFIRMARY.

THIS method of inducing anaesthesia, for operations upon the abdomen and lower limb, is of distinct value in urgency surgery; particularly so in elderly subjects where the use of inhalation anaesthesia may be a matter of considerable risk. In fifty cases where I have employed spinal anaesthesia, a general anaesthetic being at the time contra-indicated, I have had no difficulties or complications, and in half this number the patients have been 70 years of age or more. In every case the anaesthesia has been completely successful and the results distinctly satisfactory.

In elderly patients where shock, pulmonary and other complications are liable to follow general anaesthesia, spinal anaesthesia should be employed. It can be used for practically all operations upon the abdomen and lower extremity. I have found it satisfactory even when operating upon the upper abdomen, though here more care must be used in handling the abdominal contents, otherwise the patient may complain of discomfort and pain. Pulling upon the stomach is apt to cause retching or even vomiting, and contact with the abdominal surface of the diaphragm gives rise to pain in the shoulder, through the connexions of the phrenic nerve and the cervical plexus.

Spinal anaesthesia has been used with complete success for the following operations: Strangulated femoral, inguinal, and umbilical herniae; intestinal obstruction, acute appendicitis, perforated duodenal ulcer, acute pancreatitis, retention of urine due to enlarged prostate, amputation of lower limb for senile and diabetic gangrene. The following cases will serve as examples of its usefulness:

A male, aged 75 years, admitted with a strangulated femoral hernia of four days' duration. He was very distended, and the vomit was faecal in character. He had well marked bronchitis. His recovery after the operation was uninterrupted.

A female, aged 73 years, with a large strangulated umbilical hernia, cardiac weakness, and a bad chest. She made a satisfactory recovery after operation and her bronchitis became no worse.

A female, aged 64 years, sent in with a diagnosis of perforated gastric ulcer. Her pulse was so irregular and intermittent that it was uncountable. Operation was thought to be her only chance, but the anaesthetist did not consider she would stand a general anaesthetic, her condition being so bad. Stovaine was given. Laparotomy showed she was suffering from acute gangrenous pancreatitis, and the pancreas was freely drained. After discharging sloughs of pancreatic tissue for nearly three weeks she subsequently made a good recovery.

The technique adopted is as follows:

An injection of omnopon, 1 c.cm., and scopolamine, 1/300 gr., is given about half an hour before the operation. For producing the anaesthesia Barker's solution of stovaine, prepared by Billon of Paris, is used. This contains 0.05 gram of stovaine and glucose respectively in each cubic centimetre of the solution. The usual dose given was 2 c.cm., a smaller dose not being found sufficient in adults. For the injection the patient lies on his left side on the operating table, with the thighs and knees well flexed, and the head drawn down to the chest. By this means the intervertebral spaces are opened up and the introduction of the needle facilitated. His head and shoulders are raised on two pillows. The spinal needle, with stylet in position, is inserted between the second and third lumbar vertebrae, a little to one side of the middle line, and pushed inwards and slightly upwards for a depth of 2 to 2½ inches. The stylet is then withdrawn and a few cubic centimetres of cerebro-spinal fluid are allowed to flow out. Two cubic centimetres of stovaine are then slowly injected with the syringe and the needle withdrawn. Absolute asepsis must be maintained during this procedure. The patient is now placed on his back, a single pillow being left under his head and shoulders. It is of great importance not to raise the head more than this.

There is a considerable fall of blood pressure following the injection, due to the loss in tone and dilatation of the vessels of the alimentary canal and lower extremities. If the head is raised symptoms of faintness or even syncope may follow, due to cerebral anaemia. Readings of the blood pressure taken before and after the injection show the pressure may fall as much as 30 to 40 mm. of mercury after the stovaine has been administered. The patient's head and shoulders are therefore only raised sufficiently to prevent the solution reaching and paralysing the vital centres in the cervical cord. If high abdominal anaesthesia is desired, the buttocks should be elevated immediately after the injection, to enable the drug to reach the higher dorsal nerves.

The operation is commenced as soon as the screen and towels are arranged and the surgeon is ready. The patient's expression is watched when the first incision is made to see if the anaesthesia is successful; if not, the operation is delayed for a few minutes until anaesthesia is complete. I have not found that the preliminary injection of omnopon and scopolamine has any ill effects in the aged. It acts as a preventive of shock, and the patient frequently sleeps peacefully throughout the operation and is quite unaware of what is being done. If thirst is complained of, fluids may be given by the mouth.

After the operation is completed the patient must be kept flat in bed for several hours, until the blood vessels regain their tone and the blood pressure returns to normal. An injection of pituitrin may with advantage be given