ANAESTHESIA IN GENERAL PRACTICE

This is one of a series of articles, contributed by invitation

APPARATUS AND EQUIPMENT

BY

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The amount of anaesthetic apparatus required in general practice depends very largely on the practitioner himself and the type of practice in which he works. In a country practice, where major operations are infrequent and anaesthetics must often be given under difficult conditions, it would require an exceptionally keen man to carry round a McKesson apparatus with a closed circuit for carbon dioxide absorption. On the other hand, a practitioner who works in a town with a well-equipped hospital near by, where he may have to give anaesthetics for every type of operation, will hardly be satisfied with open ether as a routine. Every practitioner must have some ideas of his own on the subject, according to, first, the methods taught at his medical school and, secondly, the opportunities and inclination for keeping himself up to date while engaged in practice. It is therefore difficult to lay down hard-and-fast rules as to how much apparatus is necessary and what types are best, and I propose simply to discuss on general lines the more important aspects of the subject.

FIG. 1.—Shipway's improved warmed ether and chloroform apparatus.

Open Anaesthesia

The simplest way to give a general anaesthetic is by open inhalation. All that is required is a metal mask which can be covered with gauze or lint, and a bottle from which the anaesthetic is dropped on to the mask. The Bellamy-Gardner mask is a convenient one to use, and it should be covered with four or five layers of gauze folded into a square. If open ether is being given the overhanging gauze at the sides of the mask should be tucked inside, but this need not be done when chloroform or a mixture of chloroform and ether is being used. Some anaesthetists prefer to place a layer of gamgee tissue between the patient's face and the mask. Care must then be taken to prevent any movement of the gamgee, which might separate the eyelids and rub the cornea. When chloroform is being given

even the mask may be dispensed with and a piece of lint or the corner of a towel be employed instead. With open anaesthesia the amount of apparatus is reduced to a minimum, and when ether is used the method is nearly foolproof. The Bellamy-Gardner pattern of dropper is the one most commonly employed for administering ether, and most chloroform bottles have an outlet in the stopper through which the liquid can be delivered. A simple dropper can be improvised by inserting a small wick of gauze between the neck of the anaesthetic bottle and the cork or stopper. This allows the liquid to drip out when the bottle is tilted. A chloroform drop-bottle is convenient for giving open ether to children.

Where operations are to be performed on the mouth or nose it is impossible to maintain anaesthesia by means

FIG. 2.—Clover's ether apparatus.

of a mask, as this would obstruct the surgeon. After induction the anaesthetic must be delivered to the patient in the form of a vapour through a piece of tubing. Two simple pieces of apparatus which have proved useful for this purpose are the Junker inhaler for chloroform and the Shipway apparatus for ether or chloroform or both. The Junker inhaler consists of a bottle containing chloroform through which air or oxygen is bubbled, thus carrying the anaesthetic through the outlet tube in the form of a vapour. The Shipway apparatus contains in addition a rather larger bottle for holding ether, and the air or oxygen can be passed through either or both bottles. A vacuum flask attached to the apparatus enables the anaesthetic vapours to be warmed by passing them through hot water before they reach the patient. Both these pieces of apparatus should be tested before use to see that they are working properly. If air or oxygen is delivered at the

exit instead of the inlet tube the anaesthetic will be blown over in liquid form, and the consequences may be unfortunate. Where electrical apparatus is being employed in the mouth or throat it is preferable to drive the anaesthetic over by means of air from a bellows rather than by means of oxygen from a cylinder owing to the possible risk of an explosion. In this connexion it should be mentioned that explosions have been caused not only by the cautery and diathermy electrode but also by the tiny electric-light bulbs on such instruments as oesophagoscopes or bronchoscopes when these bulbs have become loose or the insulation has been faulty.

Closed Anaesthesia

Although open anaesthesia is easy to administer and requires the minimum of apparatus it is a wasteful method, for much of the anaesthetic is lost by evaporation into the surrounding air. With a closed apparatus more accurate control is obtained and the amount of anaesthetic necessary is reduced. The simplest form of closed anaesthesia is by means of gas and air. Apart from the cylinders of gas all that is required is a rubber bag, a face-piece, and some form of stopcock containing valves whereby an occasional breath of air may be given. This is, however, only suitable for minor operations; when longer anaesthesia is required with the addition of ether some other form of apparatus is needed.

A very simple yet efficient form of closed apparatus is Clover's inhaler or the modified pattern known as Hewitt's wide-bore inhaler. This consists of a closed container in which the ether is placed and through the centre of which is a passage-way for respiration. By turning a lever part or all of the patient's breathing can be passed over the ether in to-and-fro respiration. A face-piece at one end and a rubber bag at the other complete the apparatus. As little as three to four ounces of ether an hour is required to maintain anaesthesia, and with a small stream of oxygen delivered under the face-piece patients keep a good colour and often stand an anaesthetic given in this way remarkably well.

Rather more elaborate are the various forms of apparatus for giving gas and oxygen with or without ether. The simplest of these are the continuous-flow machines, which in principle are rather like a Shipway apparatus with a flowmeter at one end and a rebreathing bag and a face-piece at the other. The flowmeters, by which the proportions of gases delivered may be regulated, are of two main types. The older pattern consists of metal tubes which dip into a bottle of water and into which the gases flow. A row of holes down the side of each tube allow the gas to escape. The greater the flow of gas the greater will be the number of holes from which the gas bubbles. In the more modern pattern the gases pass through upright glass tubes each containing a tiny bobbin, and as the flow of gas is increased so the bobbin rises and floats at a higher level in the tube. The older type of flowmeter has the disadvantage that with the continuous flow of gas through the water a certain amount of water vapour is carried over, and this may tend to block the inlet tube in the ether bottle by turning to ice owing to the evaporation of the ether. A jacket of warmed water placed round the ether bottle will avoid this. The simplest and most popular gas-and-oxygen machine is the Boyle's pattern, and it is either used in a portable form or is incorporated with the anaesthetic trolley. Models devised by Magill and Ivor Lewis have, in addition to the bottles for chloroform and ether, a hot-water chamber for warming the ether, a manometer, and

an attachment to hold a sparklet bulb containing carbon dioxide, the whole being neat and compact. In the intermittent-flow machines the gases flow from the cylinders when the patient takes a breath, and therefore the greater the degree of rebreathing the slower is the rate of flow of the gases. Three models in common use in this country are the Walton, the Magill, and the McKesson, the last-named being the most elaborate and efficient machine. Any gas-and-oxygen apparatus can easily be fitted with a closed circuit for carbon dioxide absorption if so desired.

Equipment

Some practical points with regard to equipment may be of value to the practitioner who has to give anaesthetics.

Cylinders.—One of the drawbacks to any form of gas anaesthesia is the weight of apparatus that must be carried, most of it made up by the cylinders. It is now possible to get steel cylinders which, though they are still somewhat expensive, are considerably lighter than those in common use. Reducing valves must only be employed on cylinders containing the gas for which they are intended. Thus valves meant for cylinders of nitrous oxide must not be used on oxygen cylinders, and they should be tested from time to time by the manufacturer. Both cylinders and valves must be kept free from any sort of oil or grease.

Face-pieces and Bags.—All face-pieces are constructed with rubber pads to fit the face. These are either pneumatic or of some form of sorbo rubber. While the latter are more durable they are not so soft and yielding as the pneumatic pads, and when a really good fit is required, as in closed-circuit anaesthesia or when using a positive pressure, the pneumatic variety are more satisfactory. A helpful piece of apparatus for holding the face-piece in position is the Clausen's harness. This consists of a triangular sheet of rubber with each angle prolonged in the form of a strap containing a row of perforations. It is placed at the back of the patient's head and the straps are brought forward and hooked on to a metal ring situated over the face-piece. When properly adjusted it holds the face-piece firmly in position and leaves the anaesthetist's hands free for other duties, such as changing gas cylinders or taking the blood pressure. Rubber gas-bags and rebreathing bags which have become stiff and perished through age and lack of use can temporarily be rendered more pliable by holding them in front of a fire for a few minutes or dipping them into hot water.

Anaesthetic Agents.—Unless a practitioner administers anaesthetics frequently a large supply of ether or chloroform should not be stored as these drugs are apt to deteriorate, particularly if not kept in the dark. The bubbling of air or oxygen through ether also tends to cause decomposition, but the presence of metallic copper will help to prevent this. Many of the ether bottles in anaesthetic apparatus have their internal fittings made of copper, and one firm of chemists even nails a small piece of copper foil on the under surface of the cork in the ether bottle. Ether through which air or oxygen has been bubbled should not be kept in the bottle until such time as it is required again unless the interval is short. Stale ether need not be wasted, as it is an excellent cleaning material: it will, for example, remove paint or grease from the hands with ease. The standard of purity of ether and chloroform as supplied by the various manufacturing firms is extremely high, and all brands appear to be equally efficient in producing anaesthesia. While the same is true of ethyl chloride each brand appears to have a

characteristic odour masked to some extent by the eau-de-Cologne or lavender water that is often added. With this addition some brands are more fragrant than others, though they seem to be equally efficient as anaesthetics. It should be remembered that ethyl chloride as well as ether is a highly inflammable liquid.

Accessories

Every anaesthetist should carry an airway, a simple piece of apparatus which frequently transforms an indifferent anaesthetic into a good one. The Phillips airway is as satisfactory as any, and it should be fitted with a medium-size rubber tube rather than a large one. For

FIG. 3.—Phillips's airway.

hospital work it is an advantage to keep half a dozen on the anaesthetic trolley. Each patient can then return to bed after operation with the airway still in position, and the anaesthetist can get on with the next case without having to worry whether the last patient is likely to have his respiration obstructed before he reaches the bed. A home-made airway can easily be contrived by cutting a suitable length off a piece of rubber tubing and inserting a safety-pin through one end to prevent it being swallowed. It is of advantage to carry a mouth gag in the anaesthetic bag, but opinions differ as to the desirability of using tongue forceps.

For endotracheal anaesthesia it is necessary to have some form of laryngoscope; Magill's pattern, which contains a dry electric cell in the handle, is a popular choice. The Magill endotracheal catheters which are slightly curved are better for general purposes than the straight gum-elastic ones as they can be used for blind intubation through the nose without the need for a curved stylet. Some lubricant such as liquid paraffin or K.Y. jelly should be applied to the catheter before it is inserted.

Every anaesthetist should have a supply of drugs at hand, though these need not be excessive. For purposes of premedication morphine and atropine are still widely used, and of recent years nembutal capsules have become popular. For nervous subjects, particularly children, suppositories of nembutal have been recommended. Coramine has been found useful in the treatment of those states of emergency which sometimes occur with even the best of anaesthetists. It has also been injected at the close of an operation to diminish the action of any barbiturate which the patient may have taken as preliminary medication. For quick action it should be given intravenously. Where spinal anaesthesia is being used it is advisable to have at hand a supply of ephedrine. This, too, should be injected intravenously if a rapid action is desired. An extra cylinder is not necessary in order to have a supply of carbon dioxide available. A more convenient method is to carry it in the form of sparklet bulbs which can be fitted into a special metal container like a miniature cylinder and placed in the anaesthetic bag. In an emergency a small supply of carbon dioxide can be obtained by turning an ordinary soda-water siphon upside down and pressing the trigger. Syringes of various sizes are necessary for hypodermic injections, spinal anaesthetics, and basal narcotics such as evipan and pentothal

sodium. It is useful to have a vacuum flask when giving avertin, for the solution can then be prepared at home and taken to the patient's house or the nursing home warm and ready for use. A sphygmomanometer can be usefully employed for the double purpose of taking the blood pressure and compressing the arm before giving an intravenous injection. It is of advantage to have at hand a stomach tube when administering an anaesthetic in a case of intestinal obstruction, and some anaesthetists always carry a tracheotomy set for use in an emergency.

The foregoing list, though necessarily incomplete, contains an outline of the more important items which the occasional anaesthetist may find useful in the course of his work. In conclusion it is suggested that every anaesthetist should possess a watch with a second hand. A serviceable alternative is a theatre clock which has a large second hand or which gives a tick at every half-minute.

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BLOOD TRANSFUSION CONGRESS IN PARIS

The second International Blood Transfusion Congress was held in Paris, September 29 to October 5, under the presidency of Professor Gosset. Twenty-two nations were represented and over 100 reports and communications were made. The secretary-general was Dr. Arnault Tzanck. Dr. H. F. Brewer, Dr. S. C. Dyke, Mr. P. L. Oliver, and Mr. V. H. Riddell were among the British representatives.

The following four subjects were studied by special committees: (1) Blood groups. (2) Preserved blood. (3) Haematological problems. (4) Questions of organization.

Blood Groups

The special committee on this subject concluded that a single classification of blood groups was essential, and recommended that of $A\beta$, $B\alpha$, $AB\alpha$, and $O\alpha\beta$. It confirmed the opinion that blood groups are unchangeable and that errors due to pseudo-agglutination were avoidable, notably by dilution of the serum. Direct matching between donor and recipient was always advisable, especially in medical cases.

The committee also came to the conclusion that there was no proof of the existence of "universal donors" whose serum was dangerous owing to high titre of agglutinins. A matching test should precede each repeated transfusion, and it was recommended that the injection of a small quantity of the donor's blood before beginning the actual transfusion might well be further studied. The official control of commercially supplied testing sera was essential, and standard testing sera should be of high titre and tested periodically against corpuscles from the same subject.

In cases of urgency and when it was not possible to secure a universal donor or to obtain standard sera, direct proof of compatibility (testing the donor's corpuscles against the recipient's serum) was essential. In repeated transfusions it was useful, before each transfusion, to verify that the serum of the recipient neither agglutinated nor haemolysed the red corpuscles of the donor.

Preserved Blood

The committee praised the excellent work done in existing centres for providing fresh blood for transfusion, but to meet the need of scattered communities it was thought that regional centres should be set up from which stored blood could be distributed at need. Blood which was to be stored should be collected in the morning from a fasting donor and with the minimum of manipu-