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SIMPLE ANAESTHETIC METHODS FOR GENERAL USE

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The practical difficulties of anaesthesia can be increased to an unnecessary extent by the use of complicated apparatus—this is especially true for the relatively inexperienced administrator. When simple anaesthetic techniques are employed, however, the variety of accidents to which the patient is exposed is reduced. Indeed, the following generalization can be made: the more mechanical parts and sensitive devices an anaesthetic apparatus incorporates, the more it distracts the user's attention from the patient, and the more knowledge is required for its supervision.

Very often elaborate apparatus also requires special care from skilled technicians. Other responsibilities are added if a practitioner whose financial resources are limited, has to work in a place where medical gas supplies are expensive or difficult to obtain, or when portability is a prime consideration. A practitioner working under such conditions may justifiably feel discouraged by the fact that the authors of reports from the 'expert' anaesthetic centres of the world, in their descriptions of technique, take it for granted that more or less elaborate apparatus is available. Such reports lead to the conclusion that expensive equipment is essential for good results, and that the only alternatives to an up-to-date gas machine are open-drop ether and spinal analgesia.

The purpose of this article is to bring to the notice of general practitioners the fact that many skilled and experienced anaesthetists are tending to think in terms of greatly simplified apparatus and methods of administration. The concept of simple anaesthetic techniques is, of course, not new,[1] but there has not always been agreement on the exact nature of these techniques. Macintosh,[2] over a period of some years, has taken pains to indicate the lines that should be followed and, with his colleagues, has designed excellent equipment for this purpose.

Apparatus

For the past 18 years, the Nuffield Department of Anaesthetics at Oxford has been making use of air as a vehicle for inhaled anaesthetic vapours, and for this purpose simple quantitative draw-over inhalers have been designed. The apparatus will be desribed only briefly, because the technical details can be found elsewhere.[3]

The E.M.O. inhaler* (Fig. 1) is designed to deliver any desired concentration of ether vapour, irrespective of the variations in temperature of the liquid ether. The scale is marked from 0 - 20 volumes per cent of ether. Special E.M.O. inhalers have also been designed for the administration of other liquid anaesthetic agents, e.g. halothane, trichlorethylene and the halothane-ether azeotropic mixture.[4] The Oxford Inflating Bellows[5] (Fig. 2) was designed for use in conjunction with the E.M.O. inhaler. The bellows incorporates a compression spring so that when the patient's respiration has emptied the concertina, it will refill by drawing air into itself through the inhaler. It also affords a useful index of respiration under all circumstances. Two valves ensure unidirectional flow, and re-breathing is therefore avoided. A stopcock is provided through which the air can be enriched with oxygen, if required, and this can be done from any oxygen cylinder fitted with a reducing valve. The bellows can also be used to inflate the patient's lungs when spontaneous respiration has been depressed or abolished.

Advantages

This simple compact apparatus is a most versatile piece of equipment. Except for very small children, all types of patient can be anaesthetized with it, including thoracic, cardiac, and poor-risk cases. The apparatus can be used with a mask or endotracheal tube, and for spontaneous or controlled respiration. A non-return valve, such as the Ruben[6] or Mitchell[7] valve, can quite conveniently be used in conjunction with it. It is portable and can be used under the most cramped and difficult conditions. Maintenance problems are reduced to a minimum.

Air, as a vehicle for anaesthetic vapours, offers great advantages in that it is always available, and does not involve expenditure. Patients who have a good colour while breathing on their own pre-operatively, should retain this colour when breathing an ether-air mixture, or on being inflated with one, provided the technique is correct. As proof of this we have personally used the apparatus described for many thoracic operations, with air as the vehicle; in these cases even with the lung retracted out of the surgeon's field we have always found arterial oxygen saturations to be within the normal range.

We would recommend ether for use by the inexperienced anaesthetist because of the inherent safety that this agent offers. It must be appreciated that the suggestion of using ether-air does not necessarily imply deep anaesthesia, with

* The name of the inhaler is derived from Epstein-Macintosh-Oxford (E.M.O.).

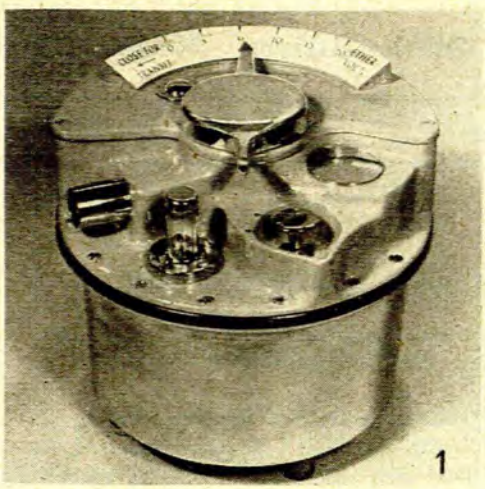

Fig. 1. The E.M.O. inhaler.

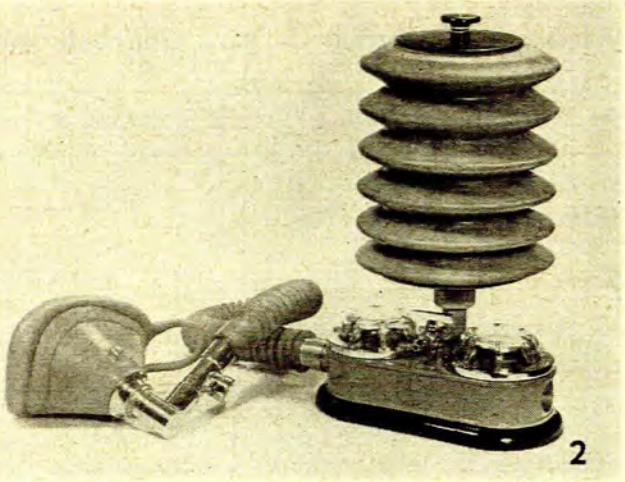

Fig. 2. The Oxford Inflating Bellows.

its unpleasant after-effects, in every case. The assumption that deep anaesthesia is necessary with ether has often clouded the argument for and against this anaesthetic agent. In fact, after induction with thiopentone and a muscle relaxant, ether can be used in a 3% concentration to ensure unconsciousness, in the same way that nitrous oxide, oxygen and pethidine are used. Light unconsciousness can be maintained with this concentration and, when muscle relaxants are used, this is all that is necessary.[8] The use of the E.M.O. inhaler also ensures the delivery of exactly the desired concentration. From experience it has been found that 3% ether is an adequate concentration to produce unconsciousness, and that this concentration can be administered for a virtually unlimited time without producing harmful effects.[2] This procedure also ensures that the patient will be awake as soon as if nitrous oxide had been employed. Alternatively, if it is not considered desirable to use muscle relaxants, ether may be used as the sole anaesthetic agent, in which case the E.M.O. inhaler provides a smoothly graduated induction. Any desired level of anaesthesia can be achieved and maintained, as can be done with other kinds of apparatus. Where analgesia is required in labour, or for such procedures as cleaning minor burns, E.M.O. inhalers designed for ether or trichlorethylene can also be used.

For those anaesthetists who have an inherent dislike of ether, specially designed E.M.O. inhalers can be used for the vaporization of halothane, the azeotropic mixture of halothane and ether, or trichlorethylene. The inhalers can also be used in conjunction with a standard anaesthetic machine as a vaporizer for volatile agents, in which circumstances they have the advantage over the use of the standard Boyle bottle of delivering accurately known concentrations whatever the liquid level may be in the vaporizer. For this reason they offer an obviously increased safety margin in cases where the anaesthesia must be handed over to a second person who may be inexperienced.

The Oxford Inflating Bellows can be used alone as a resuscitator in cases of respiratory failure, whether due to anaesthesia or disease. Because of the unidirectional valves, the system described ensures that there is no accumulation of carbon dioxide. Control of the respiration is therefore facilitated, and there is no necessity for dependence on soda-lime.

Deflagrations and Detonations

In any discussion on the use of ether as an anaesthetic agent, mention must be made of the problem of explosions. Clinically, ether is considered a safe anaesthetic agent even in the hands of a relatively inexperienced anaesthetist. However, a patient is often deprived of this safety margin offered by ether because of the administrator's fear that a fire or explosion may be produced. We must agree with the statement in the Report by the Working Party on Anaesthetic Explosions[9] that ' . . . the problem presented by the use of electrical apparatus in the theatre and elsewhere is not all told in the history of anaesthetic explosions. There are also misadventures which occur because the anaesthetist is afraid to use an explosive anaesthetic in conjunction with such apparatus.'

A clear distinction should, however, be made between the relatively innocuous *deflagrations* which might occur in ether-air mixtures, and the extremely dangerous *detonations* which result when mixtures rich in oxygen or nitrous oxide are ignited. Such detonations do *not* develop in ether-air mixtures contained in the relatively narrow ducts of our anaesthetic machines.[10] On the other hand, there is a wide range of mixtures of ether and oxygen in which the combustion process may be a violent detonation and the whole range of flammability is much wider than in ether-air mixtures.

CONCLUSION

The future of anaesthesia as a whole probably lies in the use of simple apparatus and techniques which have a universal application. We would therefore urge the occasional anaesthetist to adopt this practice. More important than all the other advantages offered by the simplicity of this approach, is the factor of safety. Not all people who are called upon to administer anaesthetics—especially in a country of vast size with limited medical facilities—can be expected to be expert anaesthetists, but they can be expected to give a safe anaesthetic. The apparatus and technique described makes such a safe anaesthetic available to anybody with medical training and a basic knowledge of the science of anaesthesia.

SUMMARY

Elaborate apparatus is not an essential requirement for good anaesthesia. There are times when such apparatus can be more of a liability than an advantage, especially when used by an inexperienced administrator, or under circumstances where complicated apparatus is poorly maintained. Simple apparatus need not limit the scope of the anaesthetist's practice. The apparatus and technique described in this paper are suitable for use under all conditions. The method involves the quantitative administration of anaesthetic vapours using air as a vehicle, through a non-return system.

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