ANAESTHESIA IN GENERAL PRACTICE

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

RECENT ADVANCES IN ANAESTHESIA

BY

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Anaesthetics as we know them to-day may be said to have started at the period which followed the war, so great an effect did the experience in casualty clearing stations and base hospitals for plastic operations have on the practice of anaesthetists. The contrast between pre-war and post-war anaesthetics is striking. Former practice was almost limited to the administration of ether or chloroform for long operations and of nitrous oxide or ethyl chloride for short ones, in addition to the employment of spinal and regional methods. Prolonged administrations of gas and oxygen were unknown in ordinary practice, and ethylene and cyclopropane had not yet appeared as anaesthetics. To-day, beside these gases, we have vinethene, the various barbiturates used intravenously, several means of basal narcosis, improved methods of spinal and epidural analgesia, and the methods of endotracheal administration.

The defects of both ether and chloroform had long been apparent. The latter was thoroughly well proved to be potentially too dangerous for a routine anaesthetic, and ether, though safe on the table, was guilty of unpleasant as well as risky after-effects. Chloroform is now mostly relegated to certain operations on the upper air passages and to midwifery. Ether is still largely used and is still a valuable anaesthetic, but its chief mode of employment in major surgery is now supplementary. It is given not as the sole or the chief agent but to strengthen when necessary the innocuous nitrous oxide, which has become the chief anaesthetic for long operations. The possibility of using nitrous oxide in this manner is solely due to improvement in the machinery of administration, and for this improvement we have to thank the Americans, and most of all the late E. I. McKesson, who had already in 1910 devised his first gas-and-oxygen machine. During the war the great advantage which nitrous oxide offered over toxic anaesthetics in many critical cases became so obvious that British medical men acting as anaesthetists at the front were led to devise and use machines capable of giving prolonged administration of the gas in a way which had not been possible with the Hewitt type of instrument, up to that time the only gas-and-oxygen machine in common use in Great Britain.

Basal Narcosis

In civil surgery it soon became apparent that there were many major operations, especially abdominal ones, for which the anaesthesia of nitrous oxide unaided was insufficient. War experience had in fact led to an overestimate of the utility of the gas. Nevertheless its advantages as an innocuous and non-poisonous agent remained undisputed, and the object now was to render it more widely efficient. This led to the premedication which is so notable a feature of present-day anaesthetics. It was found that by supplementing atropine, which was the general routine drug given before operation, if any was given at all, by a combination of this with morphine in full doses, or by using omnopon and scopolamine, then the subsequent administration of nitrous oxide and oxygen could be effective, although for abdominal relaxation in

difficult subjects considerable quantities of additional ether might still be required. The advent of avertin for the production of what now became known as "basal narcosis" still further extended the possibilities of nitrous oxide. Paraldehyde was similarly administered per rectum. The idea of rendering the patient comfortably drowsy, or actually unconscious, before he left his bed found favour rapidly. The great advantage which such a method has from the psychological standpoint when timid or nervous patients are concerned needs no demonstration.

Later still the production of hypnotic drugs belonging to the barbituric-acid group extended the anaesthetist's choice of preliminary narcotics. Pernocton, much used on the Continent, never found great favour here, but nembutal, both by the mouth and intravenously, is widely employed. Sodium amytal is warmly recommended by some, particularly for obstetrics; evipan intravenously and pentothal are extensively employed to induce unconsciousness before the main anaesthetic is brought in, or, in short operations, as the sole anaesthetic. The rapid action and freedom from all discomfort during induction which are provided by the last two agents have brought them rapid popularity, and it is sometimes overlooked that they cannot be safely regarded as the equals of nitrous oxide from the point of view of innocuousness. The intramuscular injection of evipan to supplement the intravenous injection is likely to lead to local trouble, and at least one fatality due to this procedure has been recorded.

New Inhalational Anaesthetics

While the various drugs and methods to which we have just alluded extended the scope of nitrous oxide and other gases weaker than ether vapour, the latter still remained the routine agent for much major surgery in general practice, and some specialists, valuing the safety on the table and the general efficiency of ether, sought to find out the cause and the means of preventing those unpleasant after-effects which are the great drawback to its general use. It was shown that injection of insulin before and after operation had an effect on the occurrence of toxic symptoms due to ether. It was claimed, moreover, that ether could be made the ideal anaesthetic if due attention were paid to the right bodily state of the patient beforehand, to premedication, the employment of oxygen, routine removal of endotracheal mucus by suction, and the administration of intravenous saline. The patient, according to those who advocate ether in this way, is kept for a week before operation on a meat-free high carbohydrate diet, with abundant vitamins and extra lactose. German authorities claim that with super-saturated ether vapour they abolish most of the deleterious effects of inhalation of this drug, making it unirritating to inhale and not nauseating.

Vinethene, divinyl ether, which was first shown to have anaesthetic powers in 1930, has since proved of great clinical value. Its anaesthetic potency is no less than four times as great as that of ordinary ethylic ether and is greater than that of chloroform. It acts rapidly and has been most valuable in midwifery and as a supplement to nitrous oxide. It is so volatile that it cannot well be given except from some closed form of apparatus, but with this method care has to be taken that there is

sufficient dilution with oxygen or air. Overdose leads to respiratory paralysis, and very long administration may impair the liver.

Cyclopropane, the other recently introduced inhalational anaesthetic, is also a potent gas, the value of which is enhanced by the free dilution with oxygen in association with which it is effective. For this reason it is much employed for the operations of major thoracic surgery. In connexion with cyclopropane mention must be made of the modern technique of carbon-dioxide absorption. For one thing this technique alone renders possible the free use of so expensive an agent as cyclopropane. Its economic value is, however, not the greatest of the advantages of the technique. This lies in the complete control of respiration which the method affords. The administration of carbon dioxide itself in anaesthesia is a modern feature. The physiologists have taught us that it is the natural and most efficient stimulant for the respiratory centre. Consequently it is now commonly employed to hasten induction of anaesthesia by amplifying the breathing and also to facilitate recovery by increasing the rapidity of elimination of the anaesthetic.

While technique is under discussion reference must be made to that which has done more to alter modern methods as compared with their predecessors than any other one factor. This is the introduction of endotracheal anaesthesia. The bugbear of the anaesthetist of the past was most often spasm and congestion of the tongue and upper air passages. Introduction of a catheter through the larynx into the trachea entirely does away with this difficulty. The method, in the words of Magill, whose work in this connexion has been invaluable, "prolongs the trachea" to the mouth. Moreover, this method of introducing anaesthesia has rendered possible some thoracic operations which without it would be barely possible, and has greatly facilitated operations, such as those on the cerebellum, when a prone position of the patient is necessary. Also for operations on the upper abdomen on difficult subjects endotracheal methods are often the best possible solution of the problem. Mention, too, must be made of the long and repeated operations of plastic face surgery, the requirements of which first stimulated the development of endotracheal methods in this country.

Intravenous Methods

Intravenous injection of anaesthetics was tried in many instances about twenty-five years ago. The agents employed were ether, hedonal, and isopral. The first was abandoned because it was found that the large amounts of weak solution needed were excessive and there was danger of waterlogging the lungs. Nor did the other two prove satisfactory enough for them to come into general use, chiefly because of the long unconsciousness after operation. Recently, however, the intravenous method has been reintroduced with much greater success. Good results have been recorded with ethyl alcohol infused along with glucose solution, but the best agents for intravenous anaesthesia are pentothal, evipan, and nembutal. Eunarcon, another barbiturate, gives good anaesthesia for short periods of time. Although the other barbiturates mentioned are suitable for short operations as the sole anaesthetic they are also largely given as precursors to long anaesthesia with other agents; in some hands they are themselves employed as the main anaesthetic for long operations, and for this purpose various instruments have been designed which allow the hollow needle to remain *in situ* in the vein.

To what extent intravenous will supersede inhalational methods it is at present too early to state with confidence, nor have we probably yet arrived at the best possible drug for the purpose. Allusion may be made here to the practice of injecting morphine into the vein, an effective mode of prolonging the anaesthesia of evipan, or other barbiturate, when it is waning.

Spinal Analgesia

One of the chief drawbacks to endothelial methods of analgesia used to be the comparatively short time which could be relied on for effective insensibility. The introduction of percaine, a quinolin salt, a body entirely different chemically from those hitherto employed endothecally, removed this objection. The work of the late Howard Jones put administration of this drug on a scientific basis, and his excellent clinical results are now widely imitated. Some observers have pointed out the importance of warming the solution to body temperature before injecting it. There are still considerable differences of opinion as to the physiology of spinal analgesia and as to the reasonableness or the opposite of producing in this way anaesthesia of the upper portions of the body. It is true that anaesthesia even of the scalp has been successfully obtained, and that tonsils have often been removed with the help of analgesia procured by endothelial injection, but the consensus of opinion is still in favour of limiting spinal methods to regions below the level of the umbilicus as a general rule.

The chief danger of endothelial injection is ascribed to the fall in blood pressure which is associated with it. Controversy still rages over the manner in which this is brought about. Opinion on the whole seems to favour the view that the drop depends on the number of constrictor nerve fibres which are paralysed by the injection, and that the intercostal paralysis and respiratory depression play only a secondary part. Much experimental work has been carried out to determine this question and to ascertain the degree to which absorption of the injected drug takes place into the blood stream, and whether this is in clinical practice a point of real import. It is generally held that respiratory paralysis occurring during endothelial analgesia is never primary through direct action of the drug on the bulb, but is due to secondary stoppage of the breathing through insufficient blood supply owing to excessive fall of blood pressure. Much difference of opinion has been expressed, too, as to the causation of headache, which is sometimes severe after spinal puncture. The treatment most recommended is to keep the patient's head low for twenty-four hours after return to bed. Spinal methods have recently been introduced with striking success into thoracic surgery when lobectomies and other grave intrathoracic operations have to be performed. The injection of ephedrine, of adrenaline, and of icoral is recommended by different authorities as a certain corrective or preventive of fall in blood pressure.

Mention must be made here of a form of spinal analgesia which has not yet been much tried in this country but has had enthusiastic support on the Continent and in America. It is epidural anaesthesia, and depends on injection made, not into the cerebro-spinal fluid as in ordinary spinal analgesia, but into the small layer of loose tissue outside the dura. The method is thus allied to sacral analgesia, when the injection is into the sacral hiatus and again does not involve the cerebro-spinal fluid. This technique has been much used for perineal operations, for which it is excellent.

Splanchnic analgesia—placing a block across the path of impulses passing from the viscera via the coeliac ganglia and the great splanchnic nerves to the central nervous system—has proved of great service in severe operations on the upper abdomen. It is mostly employed in combination with light general anaesthesia, or with basal narcosis, or a field-block of the abdominal wall. This form of anaesthesia has certainly made possible severe and prolonged operations on subjects who could not possibly have survived them otherwise.

Therapeutic Use of Anaesthetics

Several anaesthetics have been of service in a manner entirely different from that for which they were designed. Avertin has been invaluable in the treatment of tetanus, and has been shown to be without deleterious or toxic effect though injected on a large number of occasions at short intervals of time. Evipan has been given with success in the control of delirium tremens, and the barbiturates generally have been found of help in the treatment of mental cases, especially when prolonged narcosis is desired. Finally, it has been maintained that the good results sometimes following the mere opening of the abdomen—for example, for tuberculous peritonitis—are to be attributed not to the operation but to the anaesthetic inhaled, and it has been suggested that repeated inhalations without operation would be a beneficial form of treatment.

No survey of advances in anaesthetics should conclude without allusion to the improvements which have taken place within the last few years in the education and the professional status of anaesthetists. This is well illustrated by the recent institution of a diploma in the subject by the Royal Colleges of Physicians and of Surgeons, this diploma being to a large extent due to the instigation of the Association of Anaesthetists of Great Britain and Ireland, the existence of which body is itself an evidence of the increasing importance which is being given to the practice of anaesthetics as a specialty. Lastly, the first Chair of Anaesthetics in Great Britain has recently been instituted in the University of Oxford through the munificence of Lord Nuffield.

R. D. Evans (*Amer. J. Roentgen.*, March, 1937, p. 368) has found that about 45 per cent. of the total amount of radium stored in the skeleton in cases of chronic radium poisoning gives rise to radon in the expired breath. The amount of radon, and consequently of the radium producing it, can be determined by electrical tests on the expired air. The rest of the radium in the body is determined by the gamma rays produced by its decay product, radium C. Very sensitive quantum-counters, capable of detecting radiation from less than a millionth of a gramme of radium, permit more rapid determination of the radium C gamma rays from a living person than do the usual electrosopes. The author then describes a general method for estimating the extent to which a gamma ray gives off substance in a closed and inaccessible container. The quantum-counters are directly calibrated for rapid measurements of radium C. The rate of the loss of radium by the patient is directly measured by radium analyses of the faeces and urine. In chronic cases 0.005 per cent. a day is eliminated, 91 per cent. of this in the faeces and 9 per cent. in the urine. The mobilization of radium within the body is studied by radon analysis of specimens of alveolar air. Simple gamma-ray examinations of patients will detect chronic radium poisoning five or ten years before any clinical symptoms appear.

RHEUMATIC HEART DISEASE IN THE COUNTY BOROUGH OF DEWSBURY

BY

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The following statistics obtained at a recent survey of school children known to have suffered from cardiac disease may prove of interest. It should be pointed out that the figures refer to the numbers of children whose cardiac debility was of such a degree as to interfere with their normal mode of living to some extent, and is in no way intended to be a reflex of the total incidence of rheumatic disease in Dewsbury. These cases are listed in the school clinic records as heart cases to be examined for the purpose of determining whether they were suitable for attendance at the public elementary school, and whether or not they had recovered sufficiently to lead a normal existence.

The first table shows the classification of these cases according to fitness.

TABLE I

	Males	Females	Total
Number of children fit for public elementary school and for some exercises, but recommended for further observation	4	—	4
Number fit for P.E.S. but excluded from games and exercises	10	6	16
Fit for P.E.S. half-days. Excluded games	—	1	1
Unfit for P.E.S.	1	4	5
At open-air school	1	2	3
			25

Table II shows the number of cases suffering from heart disease directly attributable to rheumatism in some form or other. The other heart cases attributable to such diseases as pneumonia, diphtheria, etc., are classified together as non-rheumatic.

TABLE II

	Males	Females	Total
Heart debility due to rheumatism	12	8	20
Heart debility not due to rheumatism	5	4	9
			29

It is noted, then, that the majority of cases of heart debility are directly the result of rheumatic disease, in the proportion of two to one. In twenty-six of the cases the tonsils were found to be present and enlarged and ragged, or cryptic or otherwise unhealthy. It was ascertained whether or not each case had had the tonsils removed prior, or subsequent, to the onset of heart-disease, and the following table is instructive:

TABLE III

	No. of Cases
Tonsils present on examination	26
Tonsils removed	3
Tonsils removed prior to onset of disease	Nil

It will thus be seen that all of these cases had their tonsils intact before the onset of heart disease.

It was next decided to investigate the incidence of these heart cases according to the district in which the patient lived, and it was found that twenty-one lived in the town centre and eight in the outlying districts. Of the twenty-one cases in the town centre fourteen were of rheumatic origin. An analysis of these fourteen cases showed that thirteen of them belonged to the most congested part of the town centre.

The cases were then analysed with a view to discovering what schools contributed most cases, and it was found that seven of these thirteen cases came from the two schools serving the most poverty-stricken and congested area of the town. Another interesting point made out was that only four out of the total of twenty-nine cases lived in the end of the town where are housed almost all the mills, and which might be regarded as the most smoke-laden