CHOICE OF THE ANÆSTHETIC.

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In selecting the anaesthetic for the individual patient and operation, one is influenced by many considerations: age, sex, muscular development, condition of the heart, lungs, liver, kidneys, etc., also the site of the operation, whether on the brain, abdomen, etc. The anaesthetist of today has at his disposal a number of anaesthetics from which he may select the one most suitable for a given case or operation. He has also a variety of methods of administration and we must look upon the practice of using one anaesthetic in a routine way as belonging to a bygone time. To obtain the greatest success we must vary our anaesthetic and method of administration to suit the case in hand. There are not wanting, however, some who use a single anaesthetic for all purposes claiming, in the case of nitrous oxide-oxygen for example, that they obtain the best possible results by this method. Doubtless by this narrowing down and concentrating on one anaesthetic they become singularly adept in its administration. The best ultimate results however—and the object for which we are all striving—so far appears to come from an intelligent selection and skillful use of the several tried and well known anaesthetics.

It is a popular fallacy to believe that those in good health, with good muscular development, are the best risks for anaesthesia. This is not invariably the case. Of course as against those with organic disease of the heart, lungs, etc., they are much safer risks; but these being absent one usually finds the weaker, asthenic subjects, who have lain in bed for some time, prove much easier and safer cases for anaesthesia.

A greater depth of anaesthesia is usually required for the former than the latter type, and a far larger quantity of the
anaesthetic must be inhaled to produce the requisite degree of relaxation and to prevent any inconvenient reflex movements. The latter type may remain passive to surgical procedures even when the lid and corneal reflexes are fairly active. At the same time they will not hold out against a given strain as long as a stronger person.

When untoward symptoms appear during the course of the anaesthesia, the cause of these, and their remedy, is the important question with the anaesthetist and the one with which he must be able and ready to cope immediately. The quickness with which any slight variation from the normal is noted is one mark which distinguishes the skilled anaesthetist from the mere tyro.

The degree of confidence which the patient reposes in the anaesthetist, which varies much with the personality of the latter, is of the utmost importance. It tends, along with skill in administration, to prevent the period of excitement and consequent struggling which is happily much less seen now than in the past, when a less degree of skill on the part of the anaesthetist was not only tolerated, but expected; and when it was generally considered a necessary part of the procedure to hold the patient down during the second stage of anaesthesia. Any struggling, especially of a violent nature, represents a serious loss of the patient's energy. An excessive strain is thrown on one, possibly already weakened by some intercurrent disease, or who may be suffering from an impaired cardio-vascular system. There is danger of losing sight of the fact that over-exertion, or severe effort, sustained over even a short period of time by the conscious or semi-conscious subject, is sometimes followed by acute cardiac distress or syncope. Violent struggling may therefore be the cause of sudden death following operation, or of gradual cardiac failure during the postoperative period. At the best it usually leads to a poorer type of anaesthesia throughout the operation, owing to some subconscious remembrance of the period of excitement. This waste of energy added to the strain of operation, may easily turn the scale against the patient and change what might have been a successful result into a disaster.
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GOITER-THYROIDECTOMY.

The condition here varies greatly, all the way from a simple adenomatous enlargement to a severe toxic condition, with exophthalmos, heart and nervous systems. The patient may suffer from severe pressure on the trachea. The trachea is narrowed from before backward, or laterally according to the pressure. If the pressure is principally on one side, one usually gets also a displacement of the trachea, which is pushed over somewhat to the opposite side. Owing to this pressure the wall of the trachea may be thinned considerably, the rings occasionally having almost disappeared from atrophy, caused by the pressure. This condition brings us face to face with two possibilities of trouble: the trachea collapse on removal of the gland and so cause closure, partial or complete of the airway; or in the surgeon's effort to separate the gland the trachea may be torn open. Either is an exceedingly undesirable complication. Our choice of anaesthetic is, therefore, controlled by various factors. Many advocate following Crile who uses nitrous oxide-oxygen together with local anaesthesia; an admirable combination in many respects. However after considerable trial of this combination of nitrous oxide-oxygen with local and without, the author has found that with nearly all subjects the quantity of nitrous oxide is not lessened by the addition of the local anaesthetic. It is seldom necessary in either case to abolish the lid and corneal reflex. The theory that the local anaesthetic is required to cut out the transmission of impulses of the brain does not seem to be proved, for it has recently been shown, by extremely delicate galvanometric experiments, that impulses from a site of operation are only transmitted along a nerve to the first synapse when the subject is in a condition of surgical anaesthesia. The lighter stages of anaesthesia were not so effective in this respect. It has been shown also by numerous workers that similar changes in the cortical cells occur from anaesthesia alone without the stimulation of operation, also from fear, excitement, etc. Against its use is the loss of time engendered while injecting the parts and the slight oedema of tissues which make for further loss of time with those unaccustomed to work with injected tissues.
The ether-oil colonic method may be used and has the merit of keeping the anaesthetist completely removed from the surgical field.

Intratracheal insufflation, either by ether or chloroform, has been also frequently used and has the same advantage of allowing the anaesthetist to sit some distance from the site of operation. The anaesthetic can be controlled between very narrow limits and usually kept as light as with nitrous oxide-oxygen; for the mechanical nature of the respiration itself appears to have a slight hypnotic effect. There is a possible danger, though extremely remote, that in introducing the catheter into the trachea, perforation might occur when the wall is very thin from atrophy and more so if it is also displaced, so that the catheter, instead of following a straight course, has to bend by pressure against the tracheal wall. In many cases one of the vaporising inhalers with an oxygen tank attached instead of the usual motor or bellows, so as to supply oxygen along with the ether, gives excellent results. The question of expense, or absence of the necessary machine sometimes prevents the use of nitrous oxide.

Other external and internal growths may also cause obstruction to respiration. In some cases it may even be necessary to do a preliminary tracheotomy and give the anaesthetic through the tracheotomy tube. The latter is no difficult matter, the anaesthetic tube from one of the various vaporizing machines or nitrous oxide-oxygen inhalers being inserted into the tracheotomy tube; or the Trendelenburg apparatus may be used if it is desired to give the chloroform or ether by this method.

When the respiration is wholly thoracic, or wholly abdominal, as is sometimes the case, the former when the abdomen is greatly distended or the muscles held rigid as in severe ascites, intestinal obstruction, peritonitis, ovarian disease, etc; the latter in advanced emphysema or other disease of the lungs or pleura. Thoracic or abdominal respiration is often exaggerated in these cases as a matter of compensation and particular care must be exercised over the respiration and circulation. After the cause of distention has been removed the breathing becomes easier and the circulation usually improves.
In upper abdominal surgery, especially in extensive operations on the bile passages, observations have shown that a reduction of 30—40% in the output of the lungs occurs, clearly demonstrating the serious embarrassment to breathing which this surgical procedure produces. Further, deep anaesthesia is required, which renders the respiratory centre less sensitive. The traction exerted by the surgeon and his assistants still further complicates matters. The breathing is almost wholly abdominal. If using nitrous oxide it is usually necessary to supplement this with a certain amount of ether unless one is willing to carry the nitrous oxide anaesthesia to the point of "secondary saturation". Ethylene gives greater relaxation than nitrous oxide but not so great as ether. With acetylene our experience has not yet been large but it is spoken of very favourably by Weiland, Gauss, and others. In using either ethylene or acetylene one finds it advisable to commence the introduction with nitrous oxide on account of the disagreeable odour at present given off by these gases, though we are assured by chemists that when absolutely pure these gases have no unpleasant odour.

Where drainage of the abdominal cavity or of an empyema is necessary, it may often be done under local anaesthesia. There are, however, many of these cases in which a general anaesthetic is preferable, either from nervousness on the part of the patient or other reasons. Nitrous oxide-oxygen or ethyl chloride will generally be found best in these cases. The patient is usually very weak, especially in empyema; the dose of anaesthetic required is not large and either of these anaesthetics is rapidly eliminated causing little or no after distress to the patient. Nitrous oxide-oxygen has the advantage of being capable of administration under a slight positive pressure, which permits the distention of the lungs, in recent cases after the fluid is evacuated, should this be considered advisable.

In chronic pulmonary disease, chronic bronchitis, emphysema, chronic phthisis and old pleural disease, anaesthetics are taken much better than in the more recent cases. The respiratory mechanism has, by constant use, become adapted to circumstances, instead of, as in recent cases, being in process of establishment. Closed methods, speaking
generally, should be avoided, plenty of air or oxygen being allowed. Nitrous oxide-oxygen alone or with the addition of a little ether or C. E. may be used. It is more important to keep the patient well oxygenated and prevent violent respiratory efforts than to avoid the use of some other anaesthetic in combination with nitrous oxide-oxygen. If nitrous oxide-oxygen is not available, chloroform or C. E. mixture, in skilled hands, are perhaps better than ether, being less irritating to the air passages.

**The Circulatory System.**

It is often erroneously supposed that the possessors of a vigorous vascular system are good subjects for anaesthesia and that the person with a weak circulation, with organic or functional circulatory derangement is unfit to take the anaesthetic. Almost the opposite is the case, the former usually having a powerful vigorous physique, may be the cause of considerable anxiety to the anaesthetist by struggling, or muscular contraction causing impediment to free respiration. The latter usually possess comparatively feeble muscular development and pass into anaesthesia with no excitement.

In valvular and other cardiac affections extreme care must be taken not to embarrass the circulation by any restriction of air, therefore, if nitrous oxide-oxygen is used there must always be a sufficient supply of oxygen to maintain a well oxygenated condition of the blood. If necessary add ether rather than reduce the supply of oxygen below the need of the case. C. E. followed by ether, may be used on an open mask, but both are better given with oxygen through one of the vaporising inhalers.

In patients, the subjects of atheromatous arteries, there must be avoidance of struggling, holding of breath or any restriction of air during induction. Instances of cerebral hemorrhage are on record during induction with struggling and holding of breath even in chloroform anesthesia. It has occurred during anaesthesia when there was very little struggling. A preliminary dose of morphine or atropine is often advisable in these cases as it assists quiet induction.

In subjects of aneurism the same avoidance of struggling coughing, straining, etc., must be secured.
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In venous thrombosis cases have been cited, both under ether and chloroform, in which the clot has been dislodged during induction or later in the anaesthesia. It is quite probable that some of the sudden deaths recorded under anaesthetics and ascribed to their action, have been due to cardiac or pulmonary embolism.

Exhaustion, collapse, or shock may be found in patients who are the subjects of long standing illness, or some severe prostrating disease, e.g. suppurating hip disease, especially in children; advanced stricture of the pylorus, strangulated hernia, intestinal obstruction, injuries caused by machinery, etc. In these, nitrous oxide-oxygen is usually the anaesthetic to be preferred. In these patients during the anaesthesia the eyelids remain separated, the globes turned upwards so that the sclerotics only are visible and profuse sweating—another indication of exhaustion—is common. The rosy cheeks of hectic subjects and those artificially stimulated with drugs must not be allowed to deceive the anaesthetist, as these signs may coexist with a circulation totally unable to withstand a prolonged operation, though a shorter operation may be fairly well borne. Often the pulse improves somewhat under ether, but later becomes weaker and is often apt to show greater weakness when the ether is withdrawn than during its administration. This early improvement of the circulation may be due to a slight stimulation of the nervous patient's anxiety as to his condition.

In intracranial surgery ether or nitrous oxide may be used: The former is most conveniently given, by one of the vaporizing inhalers, either mixed with air or oxygen. Chloroform is preferred by some. Mixed with oxygen there is less bleeding than with ether or nitrous oxide—the brain being rendered more anaemic—probably due to the lower blood pressure of chloroform anaesthesia and when given with oxygen to the better oxygenated condition of the blood which can carry the required oxygen to the cells with less effort on the part of the heart. This is a matter of considerable convenience to the surgeon in operating: but the more pronounced breathing and fuller pulse of ether anaesthesia is a source of great comfort to the anaesthetist, being one of the chief indications left to him of the condition of the patient,
when the face is covered by towels etc. Owing to the lessened flow of blood through the brain when the intracranial pressure is increased, a higher percentage of anaesthetic in the blood is required to secure anaesthesia than when intracranial tension is normal. When the pressure is relieved by opening a dura, a considerable increase at once takes place in the volume of blood flowing through the brain so that a dangerous, or even lethal dose of the anaesthetic, suddenly bathes the medullary centres. This must be anticipated by the anaesthetist and the dose of the anaesthetic lessened or even, if considered necessary, altogether withdrawn at the time of opening this membrane.

In brain surgery, once the site of operation has been draped with towels, etc., the face is hidden. The upper part of the body is left completely to the surgeon and his assistants, the anaesthetist usually sitting about opposite the patient’s knees. He must be content with what information he can gather from the patient’s respiration and circulation as determined by the radial pulse of the side on which he sits, and can note the peripheral circulation as shown in the skin of the hand or finger nails. If taking the blood pressure also he has a still better guide to the conditions of the patient.

The method of anaesthesia may be similar to that used for a mouth operation, Doyen’s gag with anaesthetic tubes is usually retained better than an anaesthetic tube without a gag. Some prefer nasal tubes and the intra-pharyngeal methods, others the intratracheal method. By any one of these methods ether may be administered mixed with either air or oxygen. Oxygen in these cases is to be preferred mixed with ether; for in the event of any interference with free respiration, caused by the position of the head, the decrease of the volume of air breathed is compensated by its richness in oxygen. Of course if the intratracheal method is adopted, the airway is kept free by the intratracheal tube this being the principal reason for the use of the method in brain surgery.

Nitrous oxide-oxygen or nitrous oxide-oxygen with ether, is sometimes preferred and may occasionally be strongly indicated. Here the necessity for closely fitting the face mask and the large diameter and less flexible tubing used with the
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nitrous oxide apparatus makes the administration more difficult with the patient in the lying position. Care must be taken also to provide sufficient oxygen with the mixture at all times, or venous engorgement may result and materially increase the difficulties of the surgeon.

In depressed fracture, intracranial haemorrhage, cerebral abscess or tumour, the patient may be semi-conscious, when very little anaesthetic is necessary; or if in a state of coma no anaesthetic is required.

During menstruation it is better to avoid an anaesthetic unless the operation is urgent. In some patients the nervous system is more unstable during this period; further, hysterical patients may ascribe a multitude of after-effects to the fact of an anaesthetic being given, or an operation performed at this time.

During pregnancy anaesthetics may be given. Care should be taken that there is no restriction of air which might cause muscular spasm, especially in the later months. During lactation, anaesthetics may be given without interfering with the process.

In those afflicted with insanity the disease may be exaggerated temporarily, though this seems to be a rare occurrence.

In epileptics, seizures have been reported during anaesthesia. It must be of rare occurrence and one would imagine must be confined to the introduction period. In both these types particular care should be exercised to obtain a quiet induction if possible.

Occasionally in the past it has been necessary to use the actual cautery in the mouth and nose or parts adjacent to these orifices. With the advent of diathermy, now so frequently used in malignant growths of the face and its orifices, the occasions have multiplied greatly. Of the anaesthetics in use to-day all are inflammable and with a certain percentage of air or oxygen more or less violently explosive, except nitrous oxide and chloroform. In work on the upper part of the body we are therefore restricted to these two anaesthetics. Nitrous oxide may be conveniently used when the site of operation is sufficiently removed from the nose and mouth to allow the use of the ordinary facemask. Unfortunately most of our cases of diathermy are within
the mouth. Gas may be given by the nasal inhaler or by a tube in the mouth as for tonsils and dental surgery. A large quantity of gas is required to maintain anaesthesia by this method owing to the need of using pressure above that of the atmosphere so that if the operation is of long duration the question of expense arises and one must have recourse to the cheaper anaesthetic—chloroform. It is not always a question of expense, however, many surgeons preferring the latter drug which is given by one of the vaporising inhalers intended for this drug. Stocks or the ancient Junker or one of the later patterns of ether-suction machines, e.g. the McKesson, care being taken to remember that the percentages shown on the scale are for ether and that, while high percentages of that anaesthetic are required, when using chloroform only about one-sixth of the quantity is needed to produce the same effect. The latter drug being of higher specific gravity does not vaporise so readily and will therefore be presented in a less percentage than the indicator shows, so that the indicator on the McKesson machine will often be at the three per cent. mark—as shown for ether—though frequently the one or one and a half per cent. will give a sufficient strength.