The Choice of an ANAESTHETIC.

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The employment of general anaesthetics in painful surgical procedures has always been attended by more or less danger, and the risk does not seem to have become much less with increased knowledge of the physiological action of the agents. Greater freedom from accident, then, must be looked for in more attention being given to their selection and methods of administration - the anaesthetic and its mode of adminis:tration being varied according to the type and condition of the patient and the nature of the operation. Efforts have been made with a view to discovering newer and safer anaesthetics, but greater safety more probably lies in the acquisition of a more thorough knowledge of the use of those at present commonly employed.

The anaesthetics in more general use, which it is proposed to deal with here, are Nitrous Oxide Gas, Ether, and Chloroform, administered alone, or in succession, or in various combinations. They are all capable of producing complete general Anaesthesia and more or less danger accom:panies the administration of all. They vary, however, in their /

their degrees of safety, and that within fairly wide limits, and were each anaesthetic equally suitable for every oper: :ation, there would be no difficulty in selecting the proper anaesthetic, that is, the safest. But, frequently, the safest is not suited to the nature of the operation or to the type or condition of the patient to be operated upon, so that the term safest is comparatively a relative one.

The safest anaesthetic, and accordingly the one which should be chosen, is that one which, having regard to the physical condition of the patient and the nature of the operation, is likely to prove least injurious, or, under the influence of which, there is least risk of danger. In some cases, however a greater degree of safety is attained not by one alone, but by two or more agents, either in combination, or by judicious :ly alternating one with another, according to the changing conditions of the patient, or steps in the operation.

Complete freedom from danger cannot be expected from the routine use of the same anaesthetic in every case, irrespect: :ive of type of patient or operation. Certainly greater familiarity with the action of that anaesthetic will be gained /

gained by the administrator which will go far to lessen untoward results but he must occasionally meet with cases in which that anaesthetic is wholly unsuitable, and where danger, should it occur, might have been avoided by the use of another. For one who is not called upon to administer anaesthetics frequently, but who may require in emergency to do so, it might be better to use that anaesthetic with which he is most familiar, though not the most suitable, than to use another with which he has had little experience.

In each type of individual, physical condition, and class of operation, the order of safety of these anaesthetics may be somewhat different. Broadly, however, and taking a general view of the whole question of relative safety, there is a well defined order, in which, it is pretty generally admitted, these anaesthetics stand one to another in point of safety in administration and freedom from accident. A fairly good estimate may be formed from statistics, more or less reliable, of the proportion of fatalities to the number of administrations of each anaesthetic, published by various /

various authorities. These differ somewhat in their actual proportions, but are mostly agreed in their general conclu: :sions. A few of these statistics are given in Appendix I.

That much fewer deaths occur under Ether than under Chloroform is the broad fact brought out by these statistics and that Ether is therefore safer than Chloroform. On this they all agree. How much safer exactly is of little import: :ance - the difference is sufficiently marked. Doubt is frequently expressed as to the value of statistics and often with reason, but those of St. Bartholomew's Hospital have considerable value. They are the accurate record of every anaesthetic administered ^there, generally by skilled administrators, or^ under their direct supervision. The rates of the respective administrations too, are equal enough for purposes of comparison.

In examining the reports of deaths from these anaesthet: :ics, it is noticeable that in those from Chloroform, a large number occur in moderately healthy people, before, during, or after trivial operations, such as extraction of teeth, passive /

passive movement of joints, eye operations and various operations of minor surgery, in most of which no reason ex: :isted for the preference of Chloroform other than habit and custom, and where Nitrous Oxide, preeminently the safest anaesthetic, would have sufficed. On the other hand most of those fatalities occurring under Ether, take place in those exhausted by disease, many in extremis, at the time of the operation (Appendix No. II)

I am fortunately unable to state a death rate from my own series of cases, but from my experience of the occurrence of dangerous symptoms during and after certain cases of Chloro: :form administration or that of mixtures containing Chloro: :form, and the absence of these symptoms of danger during and after the administration of Ether, the broad fact is borne in upon me that Chloroform is a much more dangerous drug, than Ether. The relative frequency of these dangerous symptoms has also been brought out clearly in the Report of the British Medical Association Anaesthetics Committee and though exception may be taken to that Report on many grounds the issue is distinctly in favour of Ether.

(My /

(My own numbers of administrations of the various anaesthetics during the last three and a half to four years are given in Appendix III. It will be seen from them that Ether was administered in the majority of cases, and Chloroform, at least alone, in comparatively few: but before that period, when House Surgeon in the Glas: :gow Royal Infirmary and for the five years following in private, Chloroform was the agent mainly used. Unfortunately I did not then make written notes of these cases - they would probably have shewn a large preponderance in the number of Chloroform administra: :tions over Ether and been thus more useful for the purpose of comparison .

It is from the consideration of my experience in all administrations, however, and not on those in the Appendix alone, that I base the recommendations gener: :ally for the Employment of the various anaesthetics in the following pages)

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Putting aside Nitrous Oxide in the meantime, as it is so obviously the safest anaesthetic, and referring now to the relative safety of Ether and Chloform, it is fairly well established that so far as the absence of dangerous symptoms and death occurring during the administration, Ether is the safer anaesthetic.

But it is frequently alleged that from the after effects, more especially on the respiratory tract, this superior position of Ether in regard to safety, does not really exist. That Ether has a slightly greater tendency than Chloroform to the production of repiratory troubles is admitted by most, but these complications are not nearly so frequent as is supposed, and in the majority of cases, when they do occur they can be fairly attributed to faulty admin: :istration, in that too much is administered, the patient is saturated - the common mistake of the inexperienced - or to its administration in these few cases in which it is alto: :gether contraindicated (The frequency of repiratory compli: :cations in the hands of those who use it largely is shewn in Appendix No. IV.)

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In estimating how far the Ether alone is responsible in such cases, it should be remembered that during the administration of both Chloroform and Ether the bodily temperature falls from ½ to 2° Fah., that a large surface of the patient is frequently exposed for a considerable time, that other parts of the body near the exposed part are covered or surrounded by wet towels, at first warm but rapidly cooling, and the patient sometimes may be said to be almost lying in a pool of cool fluid. Then the temperature of the room to which the patient is afterwards removed is usually lower than that of the theatre or operating room and to get to it, he has often to be carried along a colder or draughty corridor. That these are influences which must be taken into account is shewn by the fact that respiratory troubles do sometimes take place after Chloroform, though certainly not so frequently as after Ether.

I myself have had only two cases of slight bronchitic trouble after Ether, one occurring in a short stout woman of 47 years of age who underwent an operation for the removal of the left breast and glands. The operation lasted over an hour. The bronchitis, of which there was no previous history subsided in 48 hours, and was probably due to Ether, plus

exposure /

exposure.

The other occurred after an operation for removal of Gall stones and was of similar duration. Ether alone, without contributory factors such as exposure during or after the operation, or previous history of respiratory trouble, will seldom produce these sequelae, unless given in some faulty manner - too large quantity or too concentrated vapour - too much air or as I believe is equally injurious, a too limited supply of air; but in some very few cases, despite precau: :tions, these sequelae may result. Even allowing for them, however, and classing them among cases of danger, arising from Ether administration they do not equal the number of cases of danger, chiefly of a syncopal nature, arising during Chloroform administration.

The terms "Ether pneumonia" and "Ether bronchitis" very commonly used, cannot be regarded as accurate, as there is no reason for supposing there are such specific diseases the result of Ether inhalation.

Ether certainly stimulates the secretion of saliva and mucus in the trachea and larger bronchi, and during its adminis: :tration /

:tration in some cases bubbling râles will be heard in the trachea, but this is usually relieved after the patient has vomited once or twice. This condition is to some extent reponsible for the very general impression that Ether is prone to excite bronchial trouble.

The position of mixtures containing Chloroform and Ether will be seen both as regards the death and danger rate to occupy a position between those of Ether and Chloroform , and this is what one would expect. The position, too, in which the various mixtures stand to one another, depend upon the proportion of Ether or Chloroform which they contain - those with a larger proportion of Ether approximating the Ether rate - the larger proportion of Chloroform being nearer the Chloroform rate.

There are many well known mixtures in use, such as:-

the A C E Mixture Alcohol 1 part, Chloroform 2 parts, Ether 8 parts.

Billroth's mixture, Chloroform 3 parts, Alcohol 1 part, Ether 1 part.

Vienna Mixture Chloroform 1 part, Ether 8 parts.

and /

and Schleich's Mixtures of Chloroform and Sulphuric and petroleum Ether in various strengths.

I frequently use mixtures of equal parts of Chloroform and Ether, or 1 part of Chloroform to 2 parts of Ether, but they can be used in almost any proportion and can thus be adapted to nearly every condition of patient and nature of operation. Most can be administered by the open method on a Virchow's mask or a towel, but the larger the proportion of Ether, the more must air be limited as by a Rendle's mask or cone. Besides enabling one to anaesthetise the patient more quickly the limitation of air prevents the undesirable cooling of the Ether in the air-passages.

The great objection to mixtures is the different degrees of volatibility of the various agents composing them, so that towards the end of a long inhalation, the proportions inhaled are different from at the beginning. This may be obviated to some extent by renewing the covering of the mask or towel or sponge at occasional intervals. On the whole, however, the objection is not of much moment in practice.

Having /

Having considered then the relative safety of the several anœsthetics and found their order to be Nitrous Oxide, Ether, and Chloroform, we are led to the consider: :ation of the question as to what physical condition of the patient renders each anœsthetic unsuitable for adminis: :tration in that condition.

Conditions of Patient Contra-indicating the use of Nitrous Oxide

Nitrous Oxide gas is an anaesthetic administered daily by large numbers of men with no, or hardly any knowledge of medicine, and cases in which alarming symptoms occur, are so rare that one is led to think there must be extremely few conditions of the patient in which its use is contra-indicated, and this is so.

In my own experience of 375 cases of administration of Nitrous Oxide alone or with Oxygen, I have seen nothing in the way of symptoms of the least danger occurring either during or after the administration - nothing which would cause me the slightest hesitation in administering the anaesthetic again. These cases were for the most part for the extraction of teeth or other painful dental operations and very generally in moderately healthy subjects; but many were in old and delicate subjects, and in some few, for minor surgical operations, to whom it was considered inadvisable to administer Ether or Chloroform.

There are some cases, in which it might be injudicious to /

to administer Nitrous Oxide alone, and some fewer in which the admixture of a proportion of Oxygen would not render it more safe.

The chief danger from the use of the gas given alone is the tendency, and certainty if pushed, of producing asphyxial conditions. This method of administering gas is, however, becoming much less frequently used, an apparatus for combining it with Oxygen having been brought to a fine state of perfection.

The cases, then, unsuitable for Nitrous Oxide alone, would be those where there is a considerable proportion of lung functionless e.g. from consolidation or cavities, as in advanced phthisis, or where it is collapsed or rendered useless from pressure of pleuritic fluid, as in marked pleurisy or Empyema. In these, asphyxia would occur rapidly. If the impairment of the lung be not too great, sufficient Oxygen may be given with the Nitrous Oxide to obviate it, but, as anaesthesia cannot be produced if the percentage of oxygen be too high, in much involvement of lung, an incomplete anoesthesia would result during which attempted

operation /

operation might produce shock or syncope.
In addition to the Asphyxia liable to be produced in phthisical patients, there is also the risk of exciting haemorrhage in those in whom a tendency exists.
In great feebleness of heart there is some danger of syncope but only from the strain thrown on it by the asphyxial element, a state which can be avoided entirely by the liberal use of oxygen. Thus cases of valvular disease with marked loss of compensation, and cases of marked degeneration of cardiac muscle may be looked upon as rather unsuitable cases for this as for any other anæsthetic. In such cases in addition to the proper proportion of oxygen a small propor: :tion of Ether might be advantageously used. I did so with complete success in a case of enucleation of the eyeball in which I caused the gas and oxygen , the main anæsthetic, to pass over a small quantity of Ether in a Clover's inhaler,- what might be called the stimulant adjuvant to the Anæsthet: :ic as it was not given in anything like anæsthetic quantity.

There /

There is thus for all practical purposes hardly any condi: :tion of the patient contra-indicating the use of Nitrous Oxide with Oxygen, though its sphere of usefulness is rather limited in the meantime owing to the difficulty of maintaining an even anæsthesia for long, and some technical difficulties connected with continuous supply of the agent.

Conditions of Patient Contra-indicating the use of Ether.

When we come to Ether we find a larger number of condi: :tions contra-indicating its use or generally supposed to do so.

As it has undoubtedly a slight tendency to the produc: :tion of increased secretion in the air-passages, the chief contra-indications are mainly certain conditions of the Respiratory System.

Where there is undue secretion already, Ether might lead to an embarrassing increase. Though this tendency of Ether has been much exaggerated, unless in the hands of experienc: :ed administrators it would be judicious to avoid giving it, at least by itself, in any case where there is any existing pulmonary trouble. I have frequently without having been previously been made aware of it, administered Ether to patients suffering, or recently suffering, from bronchitis, without in any way aggravating the symptoms, but I have at the same time seen pre-existing bronchitis made listinctly worse by its use.

It is a safe rule, where there is Bronchitis, especially if /

if it be acute, or chronic with much expectoration or dyspnoea, not to give Ether. Chloroform should be used in preference, but if Chloroform be also contra-indicated or if the patient does not bear it well, a mixture of the two, a compromise will usually be well borne and without exciting the undesirable effects of either. Regarding these mixtures the proportions may vary according to the intensity of the symptoms. The best ~~medicine~~ Mixture - held by some to be not merely a mechanical one - and one which does not seem to produce irritation of the air passages is the A C E Mixture: but smaller proportions of Ether may be used. Where there is much dyspnoea, it is not advisable to have a large propor: :tion of Ether or to limit the air supply unduly.

Where Emphysema accompanies the bronchitis Ether is yet more contra-indicated, also mixtures containing much Ether.

In Asthma it is usually held that Ether should be avoided. The pungent vapour may have an irritating effect and, given too concentrated, may induce an attack, and even if /

if not, is liable to induce fixity of the chest-walls and thus cause embarrassment of the breathing. In cases where Asthma is complicated with bronchitis or where it has from its persistent severity led to Emphysema, the rule is good. But in uncomplicated Asthma, it may be cautiously administer :ed without ill effect. In some cases it may even improve the condition as in the following case:-

> A young lady, asthmatic for many years and with nasal obstruction (which prevented the use of Nitrous Oxide by the nose) unable to lie in com: :pletely recumbent position had occasion to get 12 teeth extracted. Attacks very frequent, one immediately before operation. A mixture of Chloro: :form and Ether (1 part to 2) was first cautiously tried given in a sponge in cone with plenty of air holes. It was well borne, so, when well in second stage, Ether was given by the Ormsby's inhaler - the most open of the closed methods - and continued till fully under. The operation was completed. After recovery she had another attack of Asthma which /

which caused her to sit erect. Since then - many months ago- the attacks have materially diminished in frequency and severity. Chloroform alone in this case was contra-indicated from the necessar: :ily raised position of head and shoulders and there would have been great risk of syncope occurring during assumption of the erect position immediately after the operation.

In pneumonic or other consolidation of the lung Ether is contra-indicated, as tending to intensify the condition. Here again one may be justified in making an exception, by administering it in mixture, as in the following case:-

A multipard, 24 hours in labour, but making no progress, on the 4th day of an acute lobar pneumonia, half of one lung solid, pulse exceeding: :ly weak, respirations rapid, temperature 103°, patient extremely exhausted. A mixture containing 1 part Chloroform and 2 parts Ether was given on sponge in cone and was taken well. Delivery was com: :pleted with forceps in rather over one hour. The pulse and breathing improved and recovery was uninterrupted /

uninterrupted - crisis occurring three days later. I hesitated giving Chloroform alone, which was the indication from her lung condition, owing to the weak nature of the pulse, her extremely exhausted condition and the expected duration of the oper: :ation. Ether, alone, or a mixture with a larger proportion of it would probably have led to in: :creased embarrassment of breathing, if not at the time, certainly afterwards, and thus, though improving the pulse temporarily, have reacted upon it deleteriously.

In most cases of respiratory difficulty whether from pneumonia, bronchitis, emphysema, pleural Effusion or marked abdominal distension, Ether is best avoided. In the two last, the grounds are not so strong as when there is an actual inflamatory affection of the air passages, especially with much secretion.

Similarly in inflammatory affections of the larynx where the irritating effect of the vapour may induce oedema or hypersecretion Ether is contra-indicated.

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In patients, the subjects of disease of the Circulatory System, Ether in some proportion is frequently called for, but there are some conditions in which it is better avoided, viz:- those conditions of heart or vessels where undue or over-stimulation would be liable to upset compensation, or rupture friable vessels. Such cases are few, but might quite conceivably be met with. As an example of the first there is Mitral or Aortic valvular disease with pulmonary engorgement and intermittent heart, and of the second an atheromatous condition of the vessels of the brain or aneurism.

In degenerative changes of the heart e.g. fatty , Ether again might prove too stimulating, at least for long operations. In such, Chloroform is usually well borne in short operations, for longer, a mixture of Chloroform and Ether might, with good results, be substituted either from the beginning or in the course of the operation.

Many conflicting opinions have been recorded of the action of Ether on the Kidney some holding that a specific effect /

effect is produced viz:- the progressive diminution of urine secretion ending in suppression as Ether is pushed. It is generally admitted that there is a temporary slight, and in healthy kidneys not deleterious, diminution in the secretion, but suppression can only occur if the Ether has been too far pushed, the patient in fact being saturated with it. This saturation is more likely to occur if given in the American or open fashion, where large quantities are required; but where the air is limited, though not unduly as with the Orsmby inhaler a much smaller quantity suffices. If the air on the other hand be too much restricted or cut off entirely as by the Clover inhaler a congested state of the vessels both of the diseased organs and of the venous system generally is apt to be induced. These differ: :ent methods of administration - the closed, the open, and the moderately open, probably account for the discrepancies in the reports by various authorities as to the effect of Ether in producing albuminuria. In the few cases I had an opportunity of examining before and after Etherization, I found no trace of albumen in the urine, but they are too

few /

few to enable me to make a decided statement as to the effects of Ether on the Kidney.

In patients suffering from severe inflammatory affec: :tions of the Kidney - however, both Ether and Chloroform must be administered with the greatest care. The former perhaps is the more dangerous especially given by the closed method or the Entirely open one. If used, sufficient air must be given to prevent any asphyxial state.

Such cases are unsatisfactory for any anaesthetic but probably less risk is run with Chloroform.

Such are the main diseased conditions of the patient which contra-indicate the use of Ether. These are seen to be chiefly connected with the respiratory system, and are mainly unsuitable from the local action of the Ether;the few other conditions contra-indicate its stimulant properties.

Conditions of patient contra-indicating the use of Chloroform.

The chief action of Chloroform, which should act as a guide to the cases of contra-indication to its use, is the steady diminution of blood pressure which occurs in its administration.

A patient, then, who presents such a condition of feeble circulation, whether from valvular disease, degenera:tive cardiac muscle, shock, or exhaustion, that a slight lowering of blood-pressure would bring that circulation to a stand-still, would be a bad subject for chloroform.

Valvular disease of the heart, if compensation be perfect, would be no contra-indication for short administra:tions, but if compensation be to some extent lost, Chloroform alone should not be given: in long operations, the circulation is liable to fail and a little ether in form of mixture, or occasionally added alone, may help to tide the patient over the operation. It is more in the degenerative changes in the heart that Chloroform is dangerous and if the feebleness be so great that Ether alone is also forbidden from risk of over-stimulation, the A C E mixture will usually be found to act well to begin with, and the proportion of Ether, if necessary /

necessary, can be altered according to the way in which the patient bears the operation.

In feebleness of circulation from shock, the heart being healthy enough, Ether should be used.

In exhaustion a mixture is to be preferred.

From the above comparatively short list it would appear that there are really few diseased conditions which absolutely forbid the use of chloroform, or are strong contributory factors to the dangers so frequently occurring during its administration. In the many diseased conditions found, post mortem, in those who have died during Chloroformisation, the only ones which can be considered predisposing to the result are those heart conditions mentioned above. In the majority of cases no predisposing causes can be found.

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The avoiding of Chloroform, then, in these few contra--indicated conditions of disease will only help to diminish these unfortunate results in a very slight degree. But there are other reasons for the comparatively high death and danger rate, than its administration to patients, unfit subjects for it. One cause may be found in the method of administration, or want of attention or inexperience on the part of the administrator. But another, and easily avoidable one is its administration in a large number of operations, when another, and safer agent, is equally, if not, more, suitable.

Again there are conditions of patient, other than disease, which should be taken into consideration in choosing a suitable Anæsthetic. These are:-

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It is generally said that children bear chloroform well. With them, however, great susceptibility is shewn to the action of Chloroform, as to other drugs, and especially with very young children it is extremely difficult to maintain an even anæsthesia. The conjunctival reflex and other signs, which guide one with older children and adults, are of little use; the child frequently goes fast asleep and when he is thought to be nicely under the influence of the Chloroform, he wakes up with a cry and inconvenient movements. Children, too, when crying and struggling often go under suddenly, and unless /

unless one is particularly careful an overdose is liable to be given. The addition of Ether to the Chloroform causes a deeper respiration, which cannot so easily be mistaken for natural sleep and as children appear to readily fall under the anæsthetic influence of Ether, a smaller quantity of the agent is required. In the Royal Hospital for Sick Children, where I have acted as Anæsthetist for over a year, I have found the most satisfactory anæsthetic for children, under five, is a mixture of equal parts of Ether and Chloroform given on the corner of a towel or a sponge cloth. When the child is very delicate and weak, or the operation long, I increase the quantity of the Ether in the mixture to two parts to one of Chloroform. For older children, the same mixture acts admirably, though the A C E mixture or one in which the Chloroform is diluted, is preferable. One result of this addition of Ether is, children appear to stand the operation better at the time, and afterwards one does not see so much pallor and tendency to collapse in weakly children, even in long operations. The number of times I administered anæsthetics in the Sick Children's Hospital was 193, made up thus, Chloroform 45, Mixtures, 143, and Ether 5. In none of these did any alarming or dangerous symptom occur. Many of the children were in a peculiarly weak state and the freedom from accident may be attributed to the frequent taking advantage /

advantage of the stimulating qualities of Ether, by using in those more weakly cases or in severe operations mixtures containing it in various proportions.

Ether may be given alone, but is not a good anaesthetic for children, being apparently too irritating to the tender mucous membrane of the air passages, copious secretion resulting.

In old people Chloroform is, on the whole, the more suitable anaesthetic. Ether on the other hand is not so well tolerated, largely on account of the conditions incident to old age, mentioned before viz:- atheromatous or other degenerative states of vessels and chronic respiratory trouble.

In the large group between the young and the old, preference for any anaesthetic must be made on other grounds.

Persons with unstable nervous organization of both sexes take anaesthetics badly, and as most trouble and danger seem to lie in the induction of the anaesthesia, that is often best and quickest induced with Nitrous Oxide followed by Ether, Mixture, or Chloroform.

The same may be said of Alcoholics, who are wont to struggle a good deal, and anaesthesia may be happily induced in /

in the same manner but continuing with Chloroform rather than Ether. The latter is often followed by considerable excitement during recovery.

These are some of the more important conditions of the patient which might lead to the preference of one to another anaesthetic - but very few can be said to be absolute indications or contra-indications. They help at least to solve the doubt one frequently feels when other considerations are not strong enough to guide one.

A most important consideration in the choice of the anæsthetic is the nature of the operation and from attention to this a great decrease in the number of accidents would probably result.

While accidents, occurring during the anæsthesia induced for any surgical operation, are always regrettable, none are more so than when that operation is a trivial one.

Dental Operations. In no other class of cases could so many fatalities have been prevented had the most suitable anæsthetic been given.

While Nitrous Oxide, Ether, and Chloroform all have their place in Dental Surgery, Nitrous Oxide is, and has been the favourite anæsthetic and with good reason. Its great safty, its rapidity in producing narcosis, and its quick Elimination, without, except in the very few, any ill after effects, render it as perfect an anæsthetic for the purpose as could be obtained. The rapid return to consciousness, however, restricts its use in such cases to the extraction of only a few and easy teeth, but in suitable cases, by means of nasal apparatus, the anæsthesia can be continued for several minutes. The usual duration of working anæsthesia after removing the face piece is from 35 - 40 seconds, A longer anæsthesia - from 40 to 50 seconds - may be obtained by the addition of Oxygen, which, by preventing cyanosis, enables the patient to inhale /

inhale a larger quantity of Nitrous Oxide, the elimination thus taking a longer time. Nitrous Oxide plus Oxygen gives a much quieter anaesthesia and is better for the nervous and delicate than Nitrous Oxide alone. There is however a slight tendency in a few cases to a feeling of sickness after its use - actual vomiting occurring rarely - in my experience only twice in 208 cases, one after a second administration,the other in the case of a boy to whom it was administered just after a full meal. In 167 cases of Nitrous Oxide alone no vomiting occurred.

With regard to the maintenance of Nitrous Oxide Anaesthesia with a mouth tube, Dental Surgeons usually complain of its being in the way - a tube of considerable calibre being necessary. The nasal apparatus has not this objection. The best form is Paterson's,consisting of a small padded mask which fits over the nose, to which the gas is conveyed by tubes from an india rubber bag under slight pressure. Anaesthesia can be very successfully maintained with it, without much difficulty, for four or five minutes, long enough for most dental operations. Thus the necessity for Ether or Chloroform in this class of operation /

operation is obviated in many cases. It cannot be used in patients with nasal obstruction, and it is better not employed in weakly subjects owing to a certain amount of cyanosis which it is necessary to maintain. Slight move: :ments sometimes occur during its administration. No after effects, beyond a little giddiness, passing off quickly, have been observed.

This means of administering Nitrous Oxide is not readily accessible to many who are called upon to administer the anaesthetic and requires a certain amount of familiarity with the use of Nitrous Oxide. Where it is not available or where a particularly deep and long anaesthesia is re: :quired, Ether is the anaesthetic that should always be employed, unless it is strongly contraindicated from the physical condition of the patient.

Chloroform is particularly dangerous in teeth extraction. At least it would appear to be from the undue proportion of deaths occurring from it, or rather while under it.

In the Lancet Commissioners' Report on 700 deaths from Chloroform, 50 occurred during the extraction of teeth. In the /

the group of cases gathered, but in no way selected, in Appendix II, 14 occur out of 68 , a figure regrett: :ably high, considering the comparatively trivial nature of the operation. Why so many accidents should occur has been tried to be explained in many ways. The most likely causes are the faulty position of the patient, the head being high from the beginning,or the raising of the head and shoulders required by some operators to get at lower teeth, and the fact that much of the operation, and that a very painful one, necessarily takes place during a light Anaesthesia or during the return to consciousness.
The first danger,that of raising the head,may be quite discounted in short Ether administrations. In most of my cases of Ether administrations for Dental operations, the head and shoulders have been raised, many in the sitting posture in a dental chair, and in none has the least approach to syncope been observed either during or after the operation. The Second danger, that of reflex action, on the heart and vessels, usually transient, but sometimes dangerous , occurring when operating during a light Chloro: :form narcosis is not present during that of Ether, sensation /

sensation to pain being much later in returning, and even should pain be felt the dilatation of vessels resulting from the slight shock is practically without effect - there being no fall of blood pressure during at least a short Ether anaesthesia.

The raised position of the head and shoulders allowable during short Ether Anaesthesia, always provided the patient is moderately healthy, is of great advantage to the operator inasmuch as it enables him to see and operate with greater ease in the position to which he is daily accustomed. It also lessens the risk of foreign bodies e.g. teeth, falling into the larynx. An available working anaesthesia of from 5 to 10 minutes can be got after one administration of Ether and should it be necessary to again apply the face piece, it can be done with the head turned to the side to prevent the passage of blood into the throat.

If Ether should be contra-indicated a mixture is preferable to Chloroform itself, but either if used should only be given in the strictly recumbent posture . There is not so much objection to continuing an anaesthesia induced with Ether /

Ether with a mixture of Chloroform through a nasal tube attached to a Junker's inhaler.

In this class of operation, then, after Nitrous Oxide, Ether is the Anaesthetic to be employed and that even in cases where there are contra-indications to its use, if not too strong, as the risk of respiratory or other troubles is slight after such a short administration as would be necessary. The best and pleasantest way of administering the Ether is by the Clover's inhaler preceded by Nitrous Oxide: it is the most rapid and obviates struggling, complete anaesthesia being usually obtained in from 3 to 5 minutes. Those who object to a face mask may have the Anaesthesia induced with a little A C E or other mixture or Chloroform in the recumbent position and the head not raised till after a few minutes'inhalation of Ether.

Minor Surgical Operations. In small operations of short duration Nitrous Oxide ought to be used much more frequently than it is. Many operations in which it is customary to give just a whiff, and sometimes a dangerous whiff, of Chloroform /

Chloroform, might with successful results be performed under Gas, such as:-

The opening of abscesses, slitting up sinuses and fistulae, avulsion of toe nails, tenotomy, breaking up adhesions in joints or painful movement of them for other reasons, bloodless stretching of sciatic nerve, examination of rectum application of Cautery, paracentesis thoracis and many others, few being as painful as the extraction of several teeth. The only disadvantage to its use seen in some cases, is the rapid return to the consciousness of pain. A little Ether can be added to delay this.

Nitrous Oxide has been used for long operations, some anaesthetists holding there is no limit to the time which a patient may be kept under - but it is extremely difficult to maintain, throughout a long operation, an even or satisfactory deep anaesthesia. Besides, there are the difficulties, some technical, connected with the constant supply of such a large quantity of gas as would be necessary. In cases of minor surgery where Nitrous Oxide is not available the choice must be made on the other principles mentioned /

mentioned before.

Nose and Throat operations. I have used all three anaes: :thetics in this class of operation and much can be claimed for each.

Nitrous Oxide gives the operator only 40 or 50 seconds in which to do his work, unless that work is entirely limited to the throat when it can be administered through the nose for 5 or 10 minutes.

If the operator is rapid or little requires to be done Nitrous Oxide is the best anaesthetic. It can be given in any position, no ill effects follow, and the reflexes and consciousness return so quickly that there is little chance of blood being swallowed or lodging in the larynx. Where more time is required, Ether, generally preceded by Nitrous Oxide has again the advantage of enabling any position to be used, and a longer available working anaesthesia, with early return of the reflexes of the larynx.

Chloroform, again, is only permissable in the recumbent position . /

position. With the head over the end of the table, risk of accident while operating during the return to conscious: :ness is very small. The Haemorrhage is somewhat less than with Ether, also, respiratory embarrassment, when there is much obstruction in the nose and throat, less frequently occurs.

In Operations in and around the Mouth. Chloroform used throughout is best. In Harelip a mixture of Chloroform and Ether could be used but it takes longer to put the patient, usually young children, under its influence each time consciousness returns. In operations upon Cleft palate, Ether, alone or in mixtures, increases the haemorrhage to an appreciable extent, the position of the head favouring that, and this increased haemorrhage, unlike that in oper: :ations on tonsils and post-adenoids, is very inconvenient. In the excisions of the jaw, if the use of Ether be other: :wise indicated, the anaesthesia may be induced and main: :tained for a few minutes with Ether, then continued with Chloroform either in the usual open method or by the nasal tube of the Junker.

In /

In most other operations about the mouth or within it, excluding extraction of teeth, and in the pharynx or larynx especially if there be any respiratory embarrassment, Chloroform is the better anaesthetic to use.

Similarly in most operations about the Head and Neck Chloroform or a mixture is most suitable and convenient. For one reason the Ether apparatus must be frequently in the way, taking up room where little exists. There is, also, sometimes turgescence of the veins in the neck and the oozing in delicate dissections is annoying.

In operations upon the Brain and its Membranes, the vascularity of both is much increased by the use of Ether. Chloroform is generally understood to be the only anaesthet: :ic suitable for such cases. It must be used cautiously — a slow administration, and well diluted with air especially if a tendency to drowsiness or coma exists, either from the result of the lesion or from the use of morphine. The act of trephining does not require a very deep narcosis at any rate; and the oozing caused by Ether would be incon: :venient.

In /

In operations upon the Mastoid, for the same reasons, Chloroform is indicated, though I have used mixtures with a small proportion of Ether in some cases of young and weakly children.

Operations for Empyema. The administration of anaesthetics in such cases, is frequently very troublesome and accompan: :ied with considerable risk both of Syncope and Asphyxia, the former probably from the rapid escape of the fluid, relieving the pressure on the heart or on the vessels of the compressed lung, or perhaps, from the return of a dis: :placed heart; and the latter, if there be any communica: :tion between the lung and the affected pleura, from the pus finding its way into the bronchi of the sound side. Ether is apt to excite cough given alone, Chloroform with a small proportion of Ether (say $3_{\wedge}^{CHCl_3}$ to $1_{\wedge}^{Eth}$) administered just short of the abolition of reflexes answers very well, until the ribs are resected when the patient may be allowed to come further out of the anaesthetic. A mixture containing a larger proportion of Ether say equal parts, may now be given sparingly without much risk of exciting cough or respiratory embarrassment.

In /

In Operations upon the Breast, if extensive, Ether alone or in mixture with Chloroform is preferable to the latter alone. Whether from the extensive nature of the incisions required and, in the case of the left breast, the operating in the close neighbourhood of the heart or from some other reflex cause, failure of the pulse and breathing are apt to occur more frequently than may be expected proportionally. As many of the patients are stout and bronchitic, the A C E mixture is probably the most useful. It is sometimes a good plan here, as in many other operations, to put the patient deeply under Ether, and continue with a mixture or Chloroform after the large skin incisions have been made.

In abdominal section from the nature of the operation Chloroform has always been held to be the proper anaesthet: :ic, owing chiefly to the quietness of the respiration induced and the relaxing effect on the abdominal muscles. Ether on the other hand causes violent hurried respiration and fails to overcome muscular rigidity. This is true of Ether, given as most frequently it is, by the Clover's inhaler, an inhaler which cuts off entirely the supply of air. By the use of an Ormsby inhaler or some one of its modifications /

modifications, which has an air slot allowing an ample supply of air, a much quieter respiration can be induced; and so also if the anaesthetic be pushed at the beginning complete relaxation of the muscles will follow and remain relaxed afterwards even with a lighter anaesthesia. Therefore these two objections to the use of Ether are not of sufficient strength to contra-indicate it. Another factor which prevented it being much used in this class was the frequency of respiratory after-effects and the cough induced,which would tend to undo the Surgeon's work. But owing to the same improved method of administering Ether, and to greater attention being paid to the avoidance of undue exposure of the patient during and after the oper: :ation, these objections have not the same force. Certainly the majority of cases in which bronchial and pneumonic complications occurred were cases of Abdominal operations but this is also the class of case in which there is most exposure. It is sometimes said, too, that in some of the more delicate operations on the stomach and intestines and in separating adhesions the oozing is inconvenient. As a rule it is not appreciably greater, but should it be so, it is /

is quite permissible and comparatively safe to substitute Chloroform.

Another objection is the vomiting and straining said to be induced, but this is really, in toto, less than that following Chloroform. Vomiting may occur in more cases but it is usually of shorter duration and seldom of the protracted character more often following Chloroform. This I learned on enquiry from those in charge of the patients in the various Homes, and it agrees with the con: :clusion of the British Medical Association's Anaesthetics Committee.

In operations upon the stomach, handling of that organ is sometimes followed by reflex circulatory disturbance, and the sudden pallor may give rise to considerable anxiety. So also the manipulations and displacement of the intestines and the other organs in other abdominal operations is liable to interfere with the action of the diaphragm and cause embarrassed breathing. The removal of the uterus or ovaries or larger tumours may produce shock. All these disquieting incidents happen less frequently - hardly at all - in the course /

course of Ether administration and as there is really no great objection to its use in abdominal surgery from the operation itself, on the principle that the safest agent should be used, Ether is the anaesthetic, holding first place in this class of operation . In the emergency cases which frequently arise such as intestinal obstruction and the perforations of the gastro-intestinal tract Ether, or mixture with large proportion of Ether is the proper an: :aesthetic to use, the patient being usually in a very low condition.

In operations for radicle cure of hernia where coughing would be peculiarly detrimental, even though the risk of coughing being set up is extremely small, Chloroform or a mixture should be preferred and answers well.

In operations upon the Kidney , if there be much handling of that organ or if the operation be an excision, Ether is the preferable anaesthetic, and especially so if the patient is placed in the prone or semi-prone position. In these positions the breathing is much impeded from the restricted movements /

movements of the chest and abdominal walls, and this along with the shock which sometimes accompanies kidney operations might lead to dangerous symptoms. A C E mixture also acts well in this class of case after the anaesthesia has been induced with Ether, and is preferable to Ether all through if the operation is a long one. The method of administering Ether in these cases is important, only that one by which a moderate amount of air is allowed throughout, being permissable.

In operations upon the Genito urinary Organs, mixtures of Chloroform and Ether, and Chloroform itself are suitable. Castration is best performed under Ether.

Rectal operations. In this class of operation quite as strongly as in that of Dental Surgery, Ether is indicated. There is usually great embarrassment of the respiration which is of a stridulous, jerky character, partly caused by the lithotomy position and the Clover's crutch, and partly owing to the extremely sensitive nature of the parts operated upon. The sphincters here, too, are late in losing their reflexes, and for the forcible dilatation of them, the patient /

patient must be very deeply anaesthetised. Even then the act causes a few deep inspirations, which, if Chloroform be the Anaesthetic used, may result in an overdose being taken, the patient being necessarily so near the border line. Ether can be pushed with much greater safety than Chloroform if it is required, but a lighter Ether anaesthesia fulfils most requirements.

In most gynaecological operations, other than those requiring abdominal section, Chloroform is the most appro: :priate anaesthetic. The rigid parts are more readily relaxed. A light anaesthesia usually suffices for many operations of this class as curetting, and operations on the Cervix. In perineorraphy the oozing from the bared surfaces would probably be excessive with Ether. In vaginal hysterectomy the addition of Ether is advisable.

In Obstetric operations chloroform may be regarded as the proper Anaesthetic. It seems to be singularly free from risk when administered during labour, even in light anaesthesias.

It has a better effect than Ether in relaxing any rigidity

of /

of parts and is seldom followed by sickness.

In Ophthalmic Operations, a class in which a rather high death rate from Chloroform appears, there is no reason in most cases why Ether should not be used in preference. Operations on the eye, unless the patient is deeply anaesthetised, are liable to cause reflex circulatory dangers and the administration of a stimulant anaesthetic will obviate these.

The foregoing are some of the main groups of oper: :ations in which one anaesthetic may be preferred to another owing to the nature of the operation alone, but except in a few classes the indications cannot be said to be very strong. Each anaesthetic has its advantages and disadvantages, and these with different Surgeons may have different weights.

With some the advantages of improved circulation, with diminished risk of circulatory dangers, and deeper respir: :ation, with less chance of its failure, from the use of Ether, are out-weighed by the advantages of less haemorrhage and the quieter breathing of Chloroform; and the more remote chance of administering an overdose of Ether is counter: :balanced by the possibility of baneful after-effects.

To the Anaesthetist these considerations of most probable freedom from accident during the operation are apt to dwarf the others, and he is sometimes liable to think that the immediate redovery of the patient from the anaesthetic is his sole aim. It certainly is the primary end to hold in view, but the ultimate success of the oper: :ation must not be lost sight of . If that can best be

secured /

secured by incurring a slightly greater risk, it will not be contrary to the principles of the basis of selection for him to choose that anaesthetic accordingly.

The Anaesthetist's work is full of anxiety and his responsibilities are great, but by the thoughtful selection of the anaesthetic on some such clinical grounds, as has here been set down, and by giving intelligent and undivided attention to its administration, the safety of the patient, the convenience of the operator, and his own mental comfort will, to some extent, be attained.

Appendices

Appendix I

Statistics of the Death rate from the various ANAESTHETICS

(1)
St. Bartholomew's Hospital, from 1877 to 1900

Chloroform	37,914	administrations,	29 deaths.	Rate 1 in 1307
Ether	32,674	"	3 "	" 1 in 10,891

(2)
Colton Dental Association, Philadelphia.

Nitrous Oxide 147,000 administrations, no deaths or serious consequences.

(3)
Dr Ormsby, Dublin

Chloroform	152,260	administrations,	53 deaths,	1 in 2873
Ether	92,815	"	4 "	1 in 23,204

(4)
Dr Julliard, Geneva

Chloroform	524,507	administrations,	161 deaths	1 in 3258
Ether	314,738	"	21 "	1 in 14987
Mixtures of Chloroform and Ether	11,176	"	2 "	1 in 5588

(5)/

(5)
Dr Gurlt, Berlin

Chloroform 1 death in 2614

Ether 1 " " 8431

(6)
M. Landau

Chloroform	1 in 3111	German statistics
Ether	1 in 14640	
Chloroform	1 in 3749	English Statistics
Ether	1 in 16675	

(1) The Scottish Medical & Surgical Journal March 1901
(2) Nitrous Oxide: its properties &c. Guilford, Philadelphia 1887
(3) Brit.Med.Jour. 14th April 1877
(4) Rev.Med.de la Suisse Romande No.2.Feb.1891. "Anaesthetics " Hewitt 1898
(5)
(6) Quoted by Bellamy Gardner Brit.Med.Journ. 21st Aug. 1897

Appendix No. II

Analysis of 87 cases of death from Anaesthetics collected from Medical and Lay papers from 1894 to 1900 inclusive.

Chloroform	68 deaths	32 before Oper^{n}.	20 during &	16 after
Ether	13 "	1 " "	4 "	8 "
Mixtures	4 "	1 " "	2 "	1 "
Nitrous Oxide	2	-	1 "	1 "
	87	34	27	26

Nature of operation

	Chloroform	Ether	Mixtures	Nitrous Oxide
Dental	14	-	-	1
Nose & Throat	8	-	1	-
Tracheotomy	2	-	-	-
Neck (glands&Abscess)	5	-	-	1
Excision of jaw	1	-	-	-
Excision of thyroid)	1	-	-	-
Harelip	1	-	-	-
Joint (Excision)	1	-	-	-

Finger /

Nature of Oper^{n}.	Chloroform	Ether	Mixtures	Nitrous Oxide
Finger (amput.&Scraping)	4	-	-	-
Opern.on tibia	1	-	-	-
Ingrowing toe nail	1	-	-	-
Bending joints	1	1	-	-
Empyema	1	-	1	-
Paracentesis thoracis	1	-	-	-
Tumour in lung	1	-	-	-
Breast (excision)	1	-	-	-
Abdominal Section	1	7	-	-
Intestinal obstruction	1	1	-	-
Strangulated Hernia	-	1	-	-
Examination (vaginal)	2	-	-	-
Hernia(Radicle Cure)	2	-	-	-
Cancer	4	2	-	-
Bladder (cystotomy & examination)	2	1	-	-
Circumcision	2	-	-	-
Kidney (abscess)	2	-	-	-
Spinal Abscess	1	-	1	-
Rectal operns. Perineal /	1	-	1	-

Nature of Opern.	Chloroform	Ether	Mixtures	Nitrous Oxide
Perineal opern.	1	-	-	-
Eye "	8	-	-	-
Setting fracture	1	-	-	-
	68	13	4	2

These figures are of no value as statistics; the nummber of administrations not being given, they cannot shew the relative frequency of death during the anaesthesia of the various agents. They cannot be taken as shewing either the relative frequency of death during minor or major operations. But they are of value as shewing that the administration of any of these anaesthetics is not devoid of danger, that the induction of Anaesthesia before, is as dangerous as its main: :tenance during, an operation, and that when the operation is completed there is yet danger. Taking the deaths from Chloroform it must be admitted as regrettable that so many should occur when administered for trivial operations, in which probably the safest anaesthetic - Nitrous Oxide - could have been given e.g. extraction of teeth 14; oper: :ations on the finger 4; toe nail 1; bending joints 1;

Paracentesis thoracis 1; and perhaps nose & throat 8. To obviate the danger of death during the induction of Chloro: :form Anaesthesia, many use Nitrous Oxide and Ether to begin with and continue the administration with Chloroform or Mixtures. That plan might, with great advantage, be used frequently.

The cases are mostly so imperfectly reported that con: :clusions are frequently unjustifiable. Most of the fatal Ether cases occurred during severe operations or in patients in very serious conditions, and one case at least where it should never have been given viz:- in a patient with very marked Emphysema who died, immediately after, the operation, from acute Oedema of the lung. Deaths from Nitrous Oxide are so rare that the two from it were recorded in full. In one the patient - a young woman - died immediately after extraction of a tooth, from asphyxia. When she became cyanosed, the corsets, which should have been loosened, were cut open with difficulty, but too late. On after examination the corsets measured 18 ins. while the circumference of the waist equalled 23 ins. In the other case the tissues of the neck were infiltrated with pus and marked obstruction in the air passages existed.

A p p e n d i x No. II (Contd.)

Portion of
Analysis of 210 Chloroform fatalities by Dr Hewitt
&

16 Reduction of dislocations

9 Examination for injuries (including putting up fractures)

16 Eye operations

7 forcible straightening of joints

8 Application of Escharetics

7 Opening abscesses and sinuses

18 Operations upon teeth

5 Operations upon toe nail

79 or more than one third in what may be considered trifling operations.

(Encyclopaedia Medica "Anaesthetics" Vol. I)

Appendix No. III

Number and particulars of Administration of each Anaesthetic during the four years 1897 to 1900 Inclusive.

Nitrous Oxide	alone	167	
" "	combined with Oxygen	208	375
Ether	alone	27	
"	preceded by Nitrous Oxide	484	
"	" " Mixtures	106	
"	" " Chloroform	27	644
Mixtures of Chloroform & Ether		150	
and A C E Mixture		80	230
Chloroform alone			151
	Total		1400

Numbers in which dangerous symptoms were exhibited.

In the Nitrous Oxide group there were none.

In the Ether group, there was one which gave rise to some anxiety after the operation: the case of a stout elderly woman who was over an hour under Ether for Renal Calculus.

After /

Appendix No. III (Contd)

After removal to bed cyanosis and embarrassed breathing from excessive secretion in the trachea came on but were speedily relieved on vomiting.

In the Mixture group, in one case during an operation for gastro-enterostomy signs of gradual heart failure were noticed but were relieved by lowering the head and the use of Ether.

Among the Chloroform cases three cases of danger occurred. one during an exploratory operation on the kidney, when that organ was being handled, sudden syncope occurred; relieved after a few moments of artificial respiration. The anaesthesia was continued satisfactorily with Ether.

Another attack of syncope occurred during an operation on the left breast in separating that gland from its subjacent structures. Artificial respiration was resorted to with success, and the anaesthesia continued with A & E Mixture in preference to Ether, owing to the presence of bronchitis.

The third case, also of syncope, occurred in an abdominal section where extensive adhesions were being separated in the neighbourhood /

Appendix No. III (Contd.)

neighbourhood of the stomach. This, too, was relieved by prompt resort to Artificial respiration and Ether was employed to continue the Anaesthesia. No anxiety was afterwards felt as to the condition of the pulse which became good but the respiration continued unsatisfactory.

Appendix No. III (Contd.)

Analysis of the 1400 Cases

Nature of Operation	Nitrous Ox.	Ether	Chloroform	Mixtures
Dental	341	499	5	10
Minor Surgery	30	14	31	45
Nose and Throat	3	5	7	2
Harelip	-	-	6	1
Cleft Palate	-	-	8	-
Other Opers. about mouth	-	-	4	7
Brain (trephining)	-	-	2	-
Mastoid	-	1	3	2
Neck (glands)	-	3	10	11
Empyema	-	-	1	4
Breast	-	10	2	4
Abdominal Section				
Gastro-Enterostomy	-	7	-	5
Cholecistotomy	-	5	1	4
Appendix Cases	-	9	2	3
Separating adhesions	-	2	1	-
Perforated Ulcers	-	2	-	-
Hysteropexy	-	4	-	2
Ovaries (Removal & tumours)	-	5	2	1
Intestinal Obstruction	-	-	1	2
Exploratory	-	2	2	3
Other Abdominal	-	2	1	-

Appendix No.III (Contd.)

	Nitrous Ox.	Ether	Chloroform	Mixtures
Hernia				
Radicle Cure	-	5	4	20
Strangulated	-	-	-	1
Kidney				
Excision	-	1	-	3
Floating	-	7	1	4
Calculus	-	1	-	1
Abscess	-	1	-	-
Exploratory incision	-	1	1	-
Bladder (Cystotomy and Examination)	-	2	1	6
Circumcision	-	-	3	8
Castration	-	1	-	1
Other opns. on genital organs	-	3	2	6
Rectal Operations.				
Hoemorrhoids	-	13	2	1
Excision of Rectum	-	5	1	-
Fissure	-	2	-	1
Other Rectal Operations	-	-	2	3
Psoas & lumbar abscess	;	1	2	10
Hip (Excision	-	2	-	3
Other operations on Hip	-	-	1	5
Gynecological				
Curetting	-	3	16	5

Appendix No.III (Contd.)

	Nitrous Ox.	Ether	Chloroform	Mixtures
Vaginal hysterectomy	-	3	-	-
Perineorraphy	-	-	2	3
Other gynecological	-	1	4	-
Obstetric	-	3	15	5
Ophthalmic	1	4	-	1
Operations not included in above:- Extremities, joints, &c.	-	15	5	37
	375	644	151	230

Appendix IV.

Frequency of Respiratory Complications occurring after administration of Ether.

a) Mr Rumboll, Leeds.

1500 administrations. 6 Cases.

1 Bronchitis Abdominal Section, ¾ hour under Ether. Previous history of bronchitis.

1 Pneumonia (died) left breast and glands. 50 min.

4 Bronchial irritation:-

1) Abdominal section 1¼ hours. previous history. better in 48 hours

2) Abdominal Section 1½ hours. Bronchitis every winter. better in 3 days.

3) Extraction of teeth. Crown fell in larynx, but was caughtdup. better in 3 days

4) Tonsils and Adenoids. Better in 5 days.

b) Blake, Royal Free Hospital.

1250 administrations - 3 cases.

1) Fractured scapula. wheel passing over chest. developed pneumonia.

2) Fistula in ano, phthisis of right apex - made worse.

3) Radicle cure hernia - family history phthisis. Cough and expectoration for 4 days.

c) /

Appendix IV, (Contd.)

c) Julliard, 4000 administrations with no lung complication.

Mayo Robson; none in private, but some in hospital.

d) Dr. Hewitt, London Hospital.

3350 administrations - 2 cases - both previous history.

e) Carter Braine.

4380 administrations. 1 Case.

a) Transactions of Society of Andesthetists Vol.III p.57

b) Ibid. p.65

c) (Quoted by Buxton) Ibid. p.75

d) Ibid. p.101

e) Ibid. p.84