

GLASGOW  
UNIVERSITY  
12 - 1901  
LIBRARY.

ETHER ANAESTHESIA.

A THESIS WRITTEN IN APPLYING FOR THE

DEGREE OF DOCTOR OF MEDICINE

IN THE

UNIVERSITY OF GLASGOW,

May 1901,

by

WILLIAM MCGREGOR YOUNG.

M.A. M.B. Ch.M.

ProQuest Number: 13915769

All rights reserved

INFORMATION TO ALL USERS

The quality of this reproduction is dependent upon the quality of the copy submitted.

In the unlikely event that the author did not send a complete manuscript and there are missing pages, these will be noted. Also, if material had to be removed, a note will indicate the deletion.



ProQuest 13915769

Published by ProQuest LLC (2019). Copyright of the Dissertation is held by the Author.

All rights reserved.

This work is protected against unauthorized copying under Title 17, United States Code  
Microform Edition © ProQuest LLC.

ProQuest LLC.  
789 East Eisenhower Parkway  
P.O. Box 1346  
Ann Arbor, MI 48106 – 1346

## ETHER ANAESTHESIA.

Reasons for  
choosing this  
subject.

In taking Ether Anaesthesia for the subject of this thesis, I have not been determined by the idea that I have anything very novel to set forth, but have chosen it for the following reasons.

(1) A large  
experience in it.

First, that this is the one subject I know most about, my experience extending over eleven years, and amounting to something over 4,500 cases; and

(2) The neglect  
of ether in the  
Scotch Schools.

Secondly, that ether as an anaesthetic, for some not well-founded reasons, seems to be but little used in the Scotch Schools of Medicine. I may say, that during my three years of Hospital studentship in Glasgow, I did not once see ether administered. Now, here, in Leeds, almost the reverse holds good, so far at least as surgical work is concerned. In the case of women in labour, and of infants or young children requiring an anaesthetic, chloroform or a mixture of chloroform and ether is not uncommonly given, but for all other cases ether is the drug, almost invariably chosen, and is only replaced by any other, for some good and definite reason, and always given with an added sense of responsibility.

Its almost  
invariable use  
in these parts.

Why this  
difference?

Now what underlies such a marked difference

in practice, seems to be worth investigating.  
Tradition and custom cannot, or should not alone  
account for this, though they have probably much to  
do with it.

The objections  
of the Scotch  
schools to ether,  
its apparatus etc.  
and bad after-  
effects .

I think the Scotch Schools would say of ether,  
besides pleading use and wont, that it is more  
difficult to produce quiet anaesthesia with it, that  
it necessitates a more or less clumsy apparatus, that  
it has a more objectionable odour, that it more often  
produces after-sickness, and lastly that its possible  
after-results, e.g., bronchitis and pneumonia, discount  
its admittedly greater safety during administration.

The English  
objections to  
chloroform,  
it is unsafe  
even dangerous .

On the other hand I think if the question  
were put to the faculty here, Why is chloroform so  
little used in Surgical practice in Leeds? the reply  
would be, It is an unsafe drug, even in the most  
careful hands, it is a dangerous drug in any others.  
And we think that this far out-weighs its convenience  
its ease of administration, the absence of an appa-  
tus, and so on.

However I am less concerned in showing the  
dangers of chloroform, which are too real, and too  
well known to need emphasis, as in arguing for a  
greater use of ether, and in showing that the

objections to its use are not well founded.

Statements from  
experience.

I would make the following statements from my own experience, and believe them to be in keeping with the experience of other ether anaesthetists.

(1) No real  
difficulty in  
ether giving,

and even so,  
no argument for  
its neglect.

(1st) That while successful and elegant ether giving is an art that requires practice, yet to give it fairly well is not difficult. For the experienced it is an admirable anaesthetic, and for the inexperienced a safe one. Besides, that difficulties exist in the giving of it is no argument against its use, but on the contrary ought to be an excellent training for the student. It is with the difficult subject, that one takes most pains.

(2) Suitable for  
most ages and  
temperaments

and  
operations,

with few  
exceptions,

specially so  
in dentistry  
cases.

(2nd) It is a perfectly suitable anaesthetic in the vast majority of cases. So far as age is concerned, all but the very young take it well. Old people take it exceptionally well, patients of alcoholic habit or neurotic temperament do not take it worse than they would chloroform. I have not found patients with a tendency to bronchial trouble or with kidney disease take it badly or suffer afterwards. That, unless in brain surgery and in operations about the mouth and throat where continuous administration is required, it is suitable for

all other cases. I say, 'continuous', for in dentistry operations I hold it pre-eminently good.

(3) Objection to odour or taste rare.

(3rd) It will rarely be found that its odour and taste are serious objections.

(4) After-effects exaggerated.

(4th) That its after-effects as to sickness, bronchitis, pneumonia, etc are very much exaggerated.

(5) In many cases the anaesthetic by choice.

(5th) That, where the light in the room is bad, and the pupils and colour of the patient, cannot be used as guides; or where the posture of the patient is not horizontal, but in the half recumbent position as in dentistry cases, and in the prone position as in kidney operations, when Edebohl's incision is used; or where the operation is being conducted by gaslight, and chloroform is so apt to undergo decomposition, Carbonyl Chloride being evolved; ether is distinctly the anaesthetic by choice.

Where light is bad or posture of patient extraordinary,

or gas-light is used.

But examine ether on its own merits.

Having made these statements, I do not wish so much to argue for the use of ether as opposed to chloroform throughout this paper, but rather to examine the advantages and disadvantages of the drug on its own merits, with only occasional, obvious or unavoidable, comparisons between the two chief anaesthetics.

## THE ANAESTHETIC

Two kinds:-

Ethylic Ether

& Methylated Ether,

The two kinds of ether which are in constant use are (1) the Aether Purus, sp. g, '720, or absolute Ether which is prepared from pure rectified spirit, and (2) the rectified Ether sp, g, '720 which is prepared from methylated spirit. They differ slightly in odour and taste, the latter being more pungent, and in their boiling points, the latter evaporating at a lower temperature.

their differences.

Methylated Ether

cheaper and as effective,

I have used as a rule methylated ether sp, g, '720, principally because I found it in general use, and it is just possible that price may have determined this, as Ethylic Ether costs something like four times as much as Methylated. As a matter of fact many Chemist firms guarantee that their Methylated Ether answers all the tests of the B. P. Aether Purus. I confess that the Ethylic Ether has perhaps a more pleasant odour, but beyond that I am unaware of any difference in the two from the point of view of the anaesthetist and I have not been able to obtain an opinion of any value from that of the patient.

perhaps odour less pleasant.

Attempt to make pleasant by perfumes, the odour of ether.

In order to overcome the objection to the odour of ether, I have experimented, by mixing with it various perfumes, e.g. Eau de Cologne, Essence of

Roses, Oil of Lemon, Camphor, etc, with, however but small success, the rapid evaporation of the ether leaving a disagreeable residue. Still something may be achieved in this direction by a practical Chemist in the future. It might be possible to medicate the ether with some preparation, so as to modify any after-sickness or shock.

Difference in  
after-effects

probably little,  
although balance  
in favour of  
Ethylic Ether.

As regards after-effects, I am inclined to think that there is on the whole a balance in favour of the Ethylic Ether, that is, there is probably less sickness and less depression after it. It is said that patients remain longer under the influence of the Methylated than the Pure Ether, which I take to being equivalent to saying, that a larger amount of the latter is required to produce the same depth of anaesthesia. For my own part, I find that as a rule, I can keep the patient, so near the point of return to consciousness, that within a few minutes of being put into bed, he is round so far as to respond to inquiry etc.

Impurities in  
ether,

The impurities which may be present are water, alcohol, and certain not clearly defined bodies, some say Aldehyde, others, Ozone, and others again Peroxide of Hydrogen.



\*  
1) In the Leeds General Infirmary some years ago.  
The Ether in question was submitted to Professor  
Ramsay, but he could find no impurity.

never appeared  
to me present.

Failures more  
likely due to the  
anaesthetist.

Impurity possibly  
the cause here. <sup>\*</sup>  
I)

Cleanliness of  
apparatus to be  
looked to.

If impurities have ever been present in my ether, I have never detected them, always blaming myself or the patient, my own lack of dexterity or comprehension of the patient's condition, temperament, or constitution, as the causes of failure to produce sufficient and quiet safe anaesthesia. Certainly I have known and have so often seen anaesthetists who have persistently given ether indifferently even after very considerable practice, (I mean amounting to over some hundreds of cases) while a fellow anaesthetist filling his Clover from the same bottle, has as consistently given ether well, that an impurity in the anaesthetic is the last thing I should think of looking for as the cause of unhappy anaesthesia.

Recently I did see a number of cases where a careful and thoroughly competent anaesthetist had a succession of patients who behaved badly under ~~the~~ ether, in most cases showing signs of syncope. Here there may have been some impurity present. I have had no such ill luck myself.

I am careful however to see that my apparatus is not the cause, by always throwing away any ether remaining after each operation and by thoroughly rinsing out the ether Chamber and the rubber bag with

an antiseptic solution and cleansing the face piece before the next administration.

I am not aware that any cultivations of microbes have been attempted from the face piece or bag after an administration. It is possible that some light might be thus thrown on otherwise obscure cases of bronchitis, broncho-pneumonia, etc. It is said that lead shot put into the ether bottle deprives it of any impurities. A certain amount of decomposition takes place if the ether bottle be exposed long enough to the light. Of course for other and obvious reasons ether should be kept in a cool place and in well-stoppered bottles.

#### PREVIOUS PREPARATION.

As regards previous preparation, a routine has been observed which might well bear some criticism, I mean that it is doubtful whether it is for the patient's good that a prolonged fast should precede anaesthesia, and yet as I say, this is carried out in an almost routine manner, without much reference to the particular patient's condition, temperament, age, or operation about to be undergone.

Presumably, if a patient is well enough to bear an operation at all, then the routine can be observed,

and it is this; if the operation be in the morning, no food is given from the previous evening, if in the afternoon, a very light breakfast and nothing else.

Right enough for anaesthesia.

but questionable for recovery in severe cases.

Enemata might be given shortly before operation.

It is not part of the anaesthetist's work to regulate the previous preparation of the patient, and so far as he is concerned and the administration of quiet anaesthesia, I have no fault to find with this routine treatment, yet I am convinced that it might bear mending, so far as the successful recovery of the patient from the anaesthetic and operation are concerned and this especially in severe abdominal cases where for 24 hours after the operation, probably absolutely nothing is given, or at most one or two teaspoonfuls of fluid by the mouth. If it be thought inadvisable to give food within a shorter time from the hour of operation by the mouth, an enema containing some stimulant in beef-tea or milk might I think be given with advantage and without disturbing the administration of the anaesthetic. Very often a pint of saline fluid with an ounce of brandy is given per rectum immediately following operation. But why not something before?

Occasionally during the last number of years, I have been called upon to give ether in an emergency case in which the patient had shortly before

Ether taken  
quietly during  
shock.

partaken of food, and I must say that I have remarked at the time how well the patient took the anaesthetic. But of course this no doubt is true in most cases where there is shock following an accident. Here any dread of the anaesthetic or repugnance to the odour is lost in the pain and shock from the injury. Narcosis is welcomed.

Strychnia to  
anticipate shock.

As regards medicinal previous-preparation. At one time, it was not thought necessary to anticipate heart failure or shock by any medication, occasionally we did inject four or five minims of Liquor Strychninae, or in a brain case a small dose of Morphia, now we are in the habit of giving eight to ten minims of Liquor Strychninae with routine regularity in abdominal cases. I observe no adverse effect so far as quiet anaesthesia is concerned, and I quite believe it lessens shock after the operation.

Effect of  
Morphia .

Of course I have often administered ether to patients who have been receiving Morphia for therapeutic reasons previous to the operation, and have been struck by the fact that such patients seemed to take the anaesthetic more than commonly quietly and require less of it.

and of Atropine.

Some American surgeons recommend as a routine preparation a hypodermic injection of Atropine and report that it prevents undue salivation and bronchial secretion during the giving of the ether and less sickness after; of this I have no experience. It has been by the merest chance if the patient has been having Atropine or Belladonna, as in intestinal obstruction cases, previous to the giving of the anaesthetic, and I have seen too few cases to express any opinion.

Importance of proper clothing.

to prevent chill.

Until quite lately there has been one previous preparation which has been sadly neglected, that is, the proper clothing of the patient for the operation. Too often the patient was exposed, with but very little clothing on the parts covered, and a large amount of exposure of the parts near the operative area, for an hour or longer, and during this time perspiring freely, as patients <sup>often</sup> will do under ether, and yet the anaesthetic be afterwards blamed, if the patient develop bronchitis.

Enveloped in gamgee vest and drawers.

Now I believe more attention is being paid to a proper clothing of the patient, every part being well covered save the field of operation, and that made as small as consistent with the surgical manipulation, e.g., in abdominal operations with us, besides the

warm room,

hot bottle,

gamgee hood,

and dry  
sterilised towels.

ordinary nightdress, the patient is enveloped in a gamgee vest with sleeves and pair of gamgee drawers, and a hot water bottle placed at the feet, the room being kept at a temperature of about 65 degrees.

I am sure that even this is not too much, and I have seen patients who would have been all the better of having had a gamgee hood as well on the head. The area immediately surrounding the operative field should be covered by dry sterilised towels and not by wet carbolised ones which soon become cold.

From my experience, I feel sure that the more such details are carried out, the less we shall hear of bronchitis following ether administration.

I have already referred to the need for absolute cleanliness of the ether apparatus and will do no more than again emphasise the necessity for such, if trouble is to be avoided.

A proper tempera-  
ture of the room.

A proper temperature of the operating room should need no emphasis, and yet over and over again I have remarked the chill air of the room, in which a serious operation was being undertaken.

This can be mended by lighting the gases, or bringing an oil-lamp or two into the room. These latter procedures which would be wrong in the case

of chloroform administration is quite harmless in ether as no poisonous decomposition of the latter takes place.

#### THE ADMINISTRATION.

Primary difficulties  
vanish with experience.

There can be no doubt that there are certain difficulties in the way of successful ether narcosis, but most of these however vanish with sufficient experience, and indeed speaking for myself, I never anticipate and rarely find any difficulty in giving <sup>ether</sup> it, no matter what sort of patient I have to deal

to overcome the  
sour and smothering  
feeling

with. These difficulties I shall discuss later on, but one source of discomfort, common to all patients, is the not altogether agreeable odour of the ether, and still more of the choking or smothering sensation, which the patient experiences before anaesthesia is induced. To overcome this, various anaesthetics have been used up to, or near the point of anaesthesia, and afterwards followed by ether. These are nitrous-oxide gas, chloroform, or a mixture of chloroform and ether. For some time I gave nitrous oxide gas as a preliminary to ether, and although in many cases it did well and in a few number beautifully, in others its success was not so obvious, as a matter of fact, some patients complained of the same sense of smothering as in taking ether. A certain amount of cyanosis often persisted during the earlier part

we begin with  
nitrous-oxide gas  
chloroform or  
mixture.

Sections to Gas  
the cyanosis  
produced.



of the ether anaesthesia, which was rather unsightly looking if not in any sense dangerous and I think the cyanotic condition is inevitably present, if the ether be breathed by the patient, before the effect of the gas has worn off. If the patient is allowed to come round from the cyanosis induced by the gas anaesthesia, before the ether is administered, then an awkward break is apt to occur, the patient involuntarily resisting the ether by holding the breath, coughing or spluttering, and struggling. Partly on this account and partly from the awkwardness of carrying gas about with one, and from other reasons, I have not used it much of late. These other reasons are, that I have rarely found much real objection to the taking of ether. It is at the coming round from ether anaesthesia that the patient most dislikes the drug, and the preliminary nitrous-oxide gas administration does nothing to modify this. Besides to be quite sure of giving gas successfully, one would always require to carry a double Gas bottle about with one, and this would almost imply a porter to convey it. As everyone knows, the gas cylinders have a nasty way of leaking when out of use, and proving themselves empty or insufficiently filled at the moment of need, moreover the anaesthetist can scarcely manage alone the giving of gas, that is, the turning on and shutting off of the gas cylinder

Also the gas-apparatus cumbersome.

And it does not modify the after-effects.

Nitrous-Oxide Gas is difficult to administer single-handed.

preceding ether  
by chloroform,  
all right,

but usually quite  
uncalled for.

narcosis without  
the bag slow.

mode of  
procedure

by himself, and keeping the face piece applied, a second hand is almost a necessity. Speaking generally, the result scarcely justifies the amount of trouble. In the rare cases, where a nervous patient has resisted the giving of ether, either on account of fear of the smothering sensation produced by the face piece, or from the odour of the drug, I have given chloroform or a mixture, up to the point of abolition of the lid-reflex. In some hundreds of cases, I gave it as a routine on account of its being more agreeable, still I must say that as a matter of actual necessity such cases are rare. I find that most patients can and do take ether perfectly well, from the beginning. Doubtless, sometimes, a little persuasion or a little 'faking' is required thus for instance I may for a number of breaths make him inhale simply the air, gradually turning on the ether without the bag, until the patient has become quite accustomed to the odour of the drug, and in many cases have induced narcosis without having resort to the bag. This however is usually a slow process, and the bag is required for at least some considerable time, in the great majority of cases.

In detail, my ordinary mode of administering ether is as follows:-

With the face piece and ether chamber fitted

(Clover's small) and the pointer at 0, I place it on my own face and expel any odour of ether by blowing through it once or twice, then putting it on the patient's face, I allow him to take a breath or two of air, and gradually turn the chamber from  $\frac{1}{4}$  to the  $\frac{1}{2}$  and on to 1, gradually from 1 to 2, and so on to 3, during the space of a minute, then filling the bag with air, I fit it into its place, and turn the pointer back to about a  $\frac{1}{4}$ , and during the next minute or couple of minutes gradually turn the chamber round as before, so that in three or four minutes the pointer is again at 3, (the bag being on of course,) and by this time the patient is usually anaesthetised. Or as an alternative way, having allowed the patient a breath or two of air, with <sup>the</sup> pointer of the Clover at 0, I fill the bag, or preferably allow the patient to do so, and turn the Chamber gradually. Any coughing or retching or holding of the breath, or struggling would of course be a signal to turn the chamber further back and begin the process again, but this time probably more speedily. I would say even more, that any effort of deglutition should be a sign for lessening the strength of the vapour. Thus it comes to this, that I turn on the Clover till the patient makes a

Begin with air and very gradually turn on the ether,

turning back put on the bag and begin again, going slowly.

Anaesthesia reached in three to five minutes.

If coughing or retching,

or even efforts of deglutition,

then lessen the strength of the vapour,

swallowing movement, here I turn back for a breath or two, then forward again till the swallowing bars one, then back and so on, always finding that one can creep further and further forward into a stronger and more concentrated administration of the ether vapour, until this reflex is abolished. This reads long, but the whole affair is short, not more than a minute or two at most, and I think that by thus allowing the patient to swallow the mucus generated, he is saved from the after-frothiness so annoying. If any saliva or mucus escape from the patient's mouth or find its way on to the inside of the face piece, of course it should be quickly wiped away as a hindrance to quiet anaesthesia. Once the patient is fully anaesthetised and the pupillary reflex to the light abolished, the task remains one then of keeping the patient just sufficiently under during the remainder of the operation. The exact position at which the pointer should be kept, that is the amount of ether vapour that should be given, and the amount of free air that I should give the patient now and then by entirely removing the apparatus, would depend on the depth of anaesthesia required by the operation, and the state of the patient as shown by the size of the pupil also by the pulse and

and thus prevent frothy breathing.

The face piece to be kept clean, and the patient's lips.

The strength of the vapour to vary with depth of anaesthesia.

respiration.

Anaesthesia kept  
up without the bag.

I have very often indeed, dispensed with the bag altogether and kept the patient under without it, and for the last year or two invariably (that is, once full anaesthesia has been procured,) in which case the pointer would probably be at or under 3 whereas with the bag on, one or 1½ would be sufficient

This open method  
cleaner and  
sufficient  
usually.

This open method of giving ether, has always appeared to me as a much cleaner and better way of keeping up anaesthesia, granted that it is sufficient, as for example, in anaemic and debilitated subjects and probably in women and young people generally. I have not found it always sufficient in case of men, or strong florid subjects, here I have occasional resorts to the bag again, that is to the use of the asphyxial element. I have had no experience of the giving of ether on a cone, but certainly think it must be a slow process. In one case, I saw a medical man give it after this manner and I am sure that at the end of thirty minutes the patient was not then sufficiently anaesthetic for the Surgeon to begin to operate.

#### SEX AND AGE.

Women take ether  
better as a rule

Without doubt women as a rule are more easily anaesthetised than men, though this may not be owing to sex, but rather to the difference in muscular

development, an anaemic debilitated male would probably take ether with greater ease than a well developed florid woman, so that sex apart from its accompaniments matters very little.

#### A G E.

But as regards age, there are undoubted differences, children owing to the greater sensitiveness of their respiratory tract, are rarely good subjects for ether narcosis, the mucous membranes of the mouth and pharynx secrete mucus copiously, the respiration is consequently a moist and noisy one, besides there is much greater tendency to vomiting. Still I have given ether very happily in a large number of cases to children, ranging from four upwards, taking care to avoid always the asphyxial element, in fact using the bag only for a very short time at the commencement. The little patients I confess are apt to be frightened by the appearance of the Clover's apparatus and the application of the mask to the face, but usually a little persuasion overcomes this fear. I commonly indulge the children in the fiction that the apparatus is a steam engine and that they have to puff through it to make the engine go, and by thus occupying their attention, get them over the initial

Children not  
satisfactory  
subjects,

having more sensi-  
tive mucous  
surfaces,

and often  
terrified

Still amenable  
to persuasion  
or cajolery.

disagreeable stage; certainly for short operations, e.g. the removal of tonsils, adenoid growths, opening of an abscess, etc. anaesthesia by ether presents little difficulty.

In old people or elderly patients I have always been struck by the quiet and satisfactory way in which ether has been taken, and the question here is rather one of the condition of the patient, that is, as regards chest and heart, than as regards age. The propable absence of teeth in old people is certainly a difficulty. If the patient be edentulous (and this will apply of course to younger subjects as well) and a considerable amount of alveolar absorbtion has taken place, the respiration is much impeded, owing to the fact, that when the chin is pulled upwards the lips and the cheeks are sucked in, and not alone is the respiration carried on entirely through the nose, but the mask does not always adapt itself well to the rather contorted face. If the chin be not pulled up, the tongue has an awkward way of being pushed between the lips, equally impeding oral breathing, or falls back into the throat and obstructs the larynx as the patient progresses into a deeper anaesthesia. But after all, these hindrances are seldom found insuperable and for my own part, I

Elderly and old people take Ether well,

but if edentulous sometimes a difficulty

in fitting the mask,

or the tongue is protruded or falls back.

have but rarely required to abandon ether for any other anaesthetic.

#### T E M P E R A M E N T.

Neurotic patients  
take it badly

Patients of the neurotic type, certainly take ether, as indeed they do all other anaesthetics badly, their reflexes are highly responsive and manipulations which would produce but little disturbance in the phlegmatic, easily excite movements or rigidity in them.

I have often noted that long after abolition of corneal sensibility and the lid reflex and even after the pupil is widely dilated, without any response to light (showing I suppose irritation of the sympathetic dilator nerves,) even then the fingers or great toes may be seen rigidly drawn back in a state of over-extension. I have not found any theory among anaesthetic authorities of these and similar phenomena but I think one would look for their explanation in the sympathetic nervous system. It may be that in the highly-strung, that this system is more responsive to any stimulus. Yet I think most Anaesthetists would much prefer that such reflex manifestations were shown during ether narcosis than if the patient were under chloroform, in fact, under ether, the anaesthetist can afford to

but give little  
anxiety



rest without much anxiety for the patient, his only trouble is as regards the interference to the work of the Surgeon.

Alcoholics also  
difficult subjects.

The previous habits in life of the patient have of course an obvious bearing on the taking of anaesthetics, the subjects of alcoholic indulgence take much larger quantities of ether to produce anaesthesia. The stage of excitement lasts longer, and very often there is considerable rigidity and cyanosis before the patient can be pronounced anaesthetic. On the other hand once anaesthetic they are all right and I have often remarked on the absence of after effects in these cases, commonly no sickness follows, no nausea or headache, nor any antipathy to the drug.

Patients previous-  
ly anaesthetised  
said to give  
difficulty,

It is said that persons who have taken anaesthetics previously are more difficult to anaesthetise and take larger quantities to produce anaesthesia. I cannot say that I have from my own observations confirmed this, I have administered ether to patients who have had anaesthetics several times before, and in some cases have myself administered the anaesthetic four or five times to the same patient without remarking any need for an increased quantity of ether. Only the other day (December 1900) I gave ether to a patient, who had had

but have not  
found it so.

Case in point

twenty-two previous administrations, yet, he took the anaesthetic very well, the quantity actually used was four ounces, of which the greater part was administered by an open inhaler (without the bag), the administration lasting fifty five minutes, a double abdominal opening being made, one in the left groin which proved ineffectual, the other in the right Iliac region, to accomplish a typhlotomy for the relief of threatened intestinal obstruction.

#### Q U A N T I T I E S .

Quantity varies  
with time of  
anaesthesia,

and age and  
temperament, etc.  
of patient.

The quantities of ether required will of course vary with the length of time during which anaesthesia is kept up necessarily, but also with the particular patient to whom it is given. Speaking generally a big florid male patient of middle age requires more than a young lad or an old man, and the same remark applies to women, but beyond the mere bulk and age of the person, there are undoubtedly individual differences, not always easily explained. A patient of previous alcoholic habit nearly always requires a larger quantity of ether, and here the reason is obvious, but patients and especially women of the neurotic habit without any previous history of alcoholism, I have usually found also require disproportionately large quantities, but the explanation is not so easy, although no doubt the more highly

also with kind  
of operation.

strung nervous organization evidences itself under even fairly deep anaesthesia. Or it may be as I have suggested due to a more highly developed Sympathetic nerve system. The operation itself bears also some relation to the quantity of anaesthetic required. I have noticed that in pelvic operations in women where adhesions existed as a result of previous, severe, and long existing peritonitis, a deeper degree of anaesthesia and a consequently larger amount of ether was required, as for example in the removal of suppurating appendages, than in operations of apparently graver moment, I mean in total hysterectomies, stomach, or intestinal operations.

Almost twice as  
much by open  
method (without  
the bag)

Of course the amount of ~~E~~ther required is very considerably more, almost double, if the anaesthetic is given by the open method, as will be found in <sup>the</sup> note <sup>^</sup> of cases I append. Apropos of this mention of the difference between open and close method of giving ether. I have nowhere found any discussion of the relation between these two modes. A considerable difference there must be, for the patient in one case is breathing his own carbonic acid mixed with the vapour, and in the other ether mixed with air. The open method although sadly wasteful of the ether would à priori seem the better, there is certainly

less cyanosis and probably less retching, coughing etc but to this I have referred before. As regards the quantities of the preliminary anaesthetic, chloroform or a mixture, these are of no moment to this paper, but as will be seen in the table appended have usually been small.

#### THE DIFFICULTIES ARISING DURING ETHER ADMINISTRATION.

Difficulties of the beginner in handling the Clover,

supplying ether, watching the bag and fitting the mask,

the last sometimes difficult in certain faces.

There are certain difficulties which a beginner finds in handling his apparatus. As a fellow graduate of mine said to me of his early attempts in ether giving, "A man would require three hands to work this Clover with ease." But this awkwardness is soon past. What the anaesthetist has to watch is, that the supply of ether is kept up, it requires replenishing at least every 10 minutes; that the bag be not allowed to become too flaccid, still less, empty of air and that the mask be placed on the face in such a way as to fit accurately. The latter requires sometimes a bit of arranging and most outfits have at least two sizes of masks, for my own part I carry but one and can always manage perfectly. Sometimes in the patient with the prominent "Roman" nasal bridge the mask is well up on the face, its upper angle over the root of the nose, its lower end or base merely including the mouth and resting above the mental prominence. Sometimes in the

patient with the small face and sharply pointed chin the base may overlap the latter. Rarely, where the cheeks are sunken, one may actually require to put a small cotton wool or other pad beneath the rim of the mask to fill the hollow; but as a rule a nicely filled air-pad round the rim does all that is required. For the rest one becomes so accustomed to the proper "note" which a Clover gives, working harmoniously, that is, where the mask fits the face and the bag is sufficiently filled that it would be possible to produce and carry on anaesthesia blind-folded.

Difficulties met with,

coughing, retching, etc.

met by giving more air, or less concentrated vapour.

Of the difficulties of ether-giving most are met with during the early part of the anaesthetization. The patient develops a tickling cough or he retches or even vomits, or else he holds his breath and refuses to inhale. I mean when he is partly under the influence of the drug. (I do not refer here to any such troubles which may occur while he is perfectly conscious). All such difficulties are met by giving the patient more air and yet not altogether withholding the ether, that is by removing the bag and allowing the patient to breathe by the open method. Of course in event of vomiting, the mask must be sufficiently removed to allow the vomited matter to escape, the head being held on one side,

but even here it would not do to entirely suspend, unless in rare cases and certainly not for long the administration of the drug. But these troubles I do not find often occur and can always be met by a little 'faking', I can use no better term to describe the manoeuvres which experience alone can teach.

Occasionally one does meet with a patient who goes into a state of rigidity, the jaw being clenched the tongue thrust forward, the face cyanosed, the pupils widely dilated and the breath rather obstinately held, which is altogether alarming. If the patient is a muscular subject it is a very difficult matter to draw up the chin or push forward the jaw at the angles sufficiently to give the obvious demand for air. Here one should employ the gag and draw forward the tongue, but even this is not always easy with "Masseters" in a state of tonic spasm and a wooden wedge inserted between the teeth is by far the best means of levering open the jaw and getting the gag in. Once these early difficulties, if they should occur, have been overcome and the patient be in the quiet waters of complete anaesthesia, the maintaining of it ought to be, and usually is, an easy matter. I judge almost entirely by the pupil of the degree of anaesthesia; of the kind, I mean safe or otherwise, by the respiration and pulse.

Sometimes rigidity

demands the use of the gag or pulling forward of the tongue.

Pupil as guide for degree of anaesthesia and pulse and respiration for the safety.

No need to  
touch the cornea.

One would aim throughout the operation at keeping the pupil fairly well contracted and not responsive to the light ~~reflex~~. I would say here that for years I think I have not touched a patients' cornea to test anaesthesia. Apart from the chance of exciting inflammation there, it is quite unnecessary and always seem to me barbarous, in the Doric "it makes me grue." And certainly this is one of the advantages of ether over chloroform, that the patient does not suddenly vary from quiet anaesthesia into any reflex feeling, in fact, there is usually a very good margin to work in, saving what I have previously mentioned as in the case of giving it by the open method, when the patient comes more quickly round.

#### THE AFTER EFFECTS OF ETHER ANAESTHESIA.

Vomiting or  
retching very  
frequently  
present,

The after-effects of ether anaesthesia are often so inextricably mixed up with the after-effects of the operation, that it is often difficult to say what is due to the ether alone. Still on the whole it has got to be confessed that sickness, with vomiting, retching and nausea, is very frequently present, unless in minor cases, or in a few individuals. The vomiting while probably more commonly present than after an administration of chloroform, lasts but

but very rarely  
of a grave nature,

nausea frequent,

depression also,  
but this may be  
due to the opera-  
tion in part.

a short time, is usually over before the patient returns to full consciousness, and is much more rarely as grave as when the latter anaesthetic is given. I do not think that I have ever seen a case in any sense comparable to the uncontrollable vomiting of chloroform. On the other hand even after the early and almost inevitable vomiting, there often persists an amount of nausea which is very trying to the patient and an intense craving for fluids which it is often impossible to gratify, specially after major operations, unless by a rectal injection. I have often noticed moreover a very considerable amount of depression, after a long ether administration which may be due no doubt partly to the operation but for which the ether may be partly responsible. At all events I am assured by those who have carefully noticed in similar cases after chloroform giving that it is less frequent and less pronounced with the latter drug. On this doubtful point my experience is not large enough to entitle me to speak with any authority. Only a careful comparison of many similar cases in some of which ether had been used, and in others another anaesthetic, would justify one in saying what was due to the operation and what to the anaesthetic.



I have seen during this last ten years a fair number of operations performed under Cocaine, I mean, major operations as e.g. Radical cure of Hernia, Laparotomy etc. and for comparison no doubt these cases would be admissible. Undoubtedly after Cocaine the patient though often pale, sickly and faint, looks less unhappy than he would have been if Ether had been given, however there is of course a good deal more pain after, for the effect of the Ether in dulling sensation lasts for a considerable time, perhaps hours after the patient has been back into bed, and this is more marked than would be the case even with chloroform.

*an*

Of course one meets many cases in experience lasting over years, where ether seems a perfectly agreeable anaesthetic to the patient, but this is usually where the administration has been but short and the operation of the less grave kind, I mean not involving much exposure of viscera, breaking down of inflammatory adhesions internally etc. One patient I remember, a German and musically inclined, spent a most delightful time, he said, listening to a symphony, through which ran a ravishing melody but it was in vain he tried to recall the 'motif' on his return to reality, although he assured me it haunted him all the day. Another patient told me

Sometimes ether  
actually enjoyable

Musical case

Thompson's papers, and I had not seen Kemp's paper



he had a glorious sense of flying through clear, pure space, an exultation of spirits unknown to his sober senses. A medical man at my request gave me answers to questions right up to insensibility but it amounted to nothing more than getting drunk and more drunk but never unhappy. Most patients hear a surging of waves or the ringing of bells, or the beating of hammers. It may be that on the borderland, the processes of the body which to our normal conscious hearing are silent become audible to the finer sense then induced, like

" . . . . the fairy-folk a-listening

"Hear the seed sprout in the Spring."

There is one after effect of ether, which I think has not received as much attention as it merits, nor has been made so far as I know, the subject of careful study and that is the appearance of albumen in the urine. My friend Dr. <sup>r</sup>Fraquharson Macrae and myself have made a very careful analysis of the urine in over a hundred consecutive cases and have come to the following conclusions.

(1st) That albumen, often certainly but a faint trace, is present in the urine of the great majority of patients after ether administration viz. in 83.75

\* (written before the appearance of Buxton & Levi or Thomason's papers and I had not seen Kern's paper)

Albumenuria as an after effect

Conclusions  
(1) commonly present  
(2) for 24 hours

per cent (2nd) That it persists on an average for 24 to 48 hours.

(3) and not dependent on quantity of ether given

(3rd) That this does not seem wholly dependent on the amount of ether given, nor on the satisfactory or unsatisfactory way in which it was taken, nor on the nature of the operation, nor age of the patient, although no doubt all these factors account largely for both its appearance and persistence. I give below a table of a number of the cases illustrating our mode of observation and an analysis of the total number, and what deductions we can make from them.

Schleich's mixture, consists of a mixture of  
Sulphuric Ether Petroleum Ether and Chloroform x  
(Chloroform to Ether 1 in 5)  
about

# T A B L E.

Date 1899	Name	Age	Operation	Anaesthetic	taken	time	URINE before	12 after hrs	24 hrs after trace(?)	disappearance after
May 4.	Capt. T--	30	Laparotomy	C. 4drs E. 1 oz.	Cyanotic	60 min.	nil	trace		24 hrs
8.	Mrs. H.--	40	Cholecystotomy	E. 6 oz.	well	60 "		trace	trace	24 "
"	Miss F--	38	Hysterectomy	E. 4 oz.	"	75 "		much and blood	slight	24 "
9.	Mr. H--	44	Appendectomy	C. 1 oz.	"	45 "	nil	slight	nil	12 hrs
12.	Mrs. P--	54	Cholecystectomy	E. 4 oz.	v. well	30 "	nil	"	trace	48 hrs
17.	Mr. D--	65	Colotomy	E. 1½ oz.	" "	30 "	trace	"	trace	60 hrs
"	Miss D--		Curetting	E. (?)	" "	35 "	nil	trace (?)	nil	12 hrs
20.	Miss H--	40	Laparotomy	E. 2½ oz.	" "	45 "	nil	slight	trace	48 hrs
"	Miss H--	33	Nephrotomy	E. 2½ oz.	" "	40 "	Pus	Pus	Pus	--
"	Mrs. M.--	45	Hernia Rad Cure.	E. 3 oz.	" "	45 "	nil	trace	nil	12 hrs.
× 22.	Mast. B--	12	Hernia (Abdominal)	Ethyl E 3oz Schlach's	1 oz. Vomiting	45 "	nil	trace	nil	24 hrs
"	Mr. N.--	56	Excisn. Tongue Kocher.	Ethyl E 1½ oz. Sch.	2½ oz. v. well	75 "	nil	trace	nil	24 hrs.
June 6	Miss P.-	26	Gastro-plasty	Ethyl. E 4oz"	" "	60 "	nil	slight	trace	72 hrs
"	Mr. A.--	50	Duodeno-Choledoch- otomy.	" E 4oz"	" "	60 "	trace	large	trace	48 hrs
10	Mr. W.--	45	(Hepatectomy (par- tial).	C 2dr. E 9oz"	" "	100 "	nil	large	large	10 days
"	Miss H.-		Hysterectomy	Gas & E(?)	" "	90 "	nil	slight	trace	48 hrs
12	Mr. F.--		Hernia (double)	Cocaine ½ gr.	- - -	- - -	nil	trace	trace	(?)
"	Miss H.-	28	Mamma Excisn.	E. 3oz.	well	30 min.	nil	trace	slight	72 hrs
"	Mr. W.--		Haemorrhoids	Gas & E.	badly		nil	trace	trace	30 hrs
15	Miss T.-	28	Appendectomy	Sch. 2dr. E 6oz.	well	75 min.	nil	fair	slight	24 hrs
15	Miss I.-	36	Cholecystotomy	Ethyl E 4oz.	v. well	45 min.	nil	nil	nil	--

Analysis of the record of 100 cases

No albumen before - 80 per cent. Albumen before  
- 20 per cent.

Albumen after - 86 per cent. No albumen after - 14  
per cent.

But as one case had albumen before and none  
after, this gives only 13 cases in 80 in which  
albumen was absent after operation as well as before.  
that is:-

Where no albumen  
before operation.

{ 83.75 per cent show albumen  
{ 16.25 per cent show no albumen  
{ in cases found previously free from albumen

Where albumen  
present before.

{ Of those cases in which albumen was present  
{ before operation, in 6 the amount was increased, and  
{ in 7 not increased, that is in nearly half the  
{ number there was an increase of albumen. In one  
{ case the albumen disappeared

average quantity  
of ether given.

The average quantity of ether given was about  
1 ounce per 15 minutes, some cases recorded as low  
as 1 ounce per 20 to 25 minutes and most of these  
were in part without the bag on the Clover.

93 per cent major  
operations.

Of the operations 56 per cent were abdominal  
operations, and only 7 can be classed as minor  
operations, the reason for this being that I was  
only called upon to give anaesthetics as a rule in  
major operations. The average disappearance of  
albumen from the Urine was in from 24 to 36 hours,

time of disappearance of albumen.

in some cases it persisted for a number of days, of course in the majority of cases the albumen present was merely a trace.

Theory to account for albumen.

I cannot pretend to give a theory which would account for this albumenuria, it is possible it may be due to passive congestion of the kidneys, or it may be due to some irritant in the ether acting on the epithelium of the uriniferous tubules. I am not aware that a similar investigation has been  
2x undertaken in the case of chloroform, but it would be interesting to know the result of such. Certainly in the few chloroform cases which occurred during the period of the 100 ether cases tabulated, we found albumen present.

Since writing this, several papers have appeared on this subject, the following is a resumé.

10  
Kemp's observations

Kemp found in physiological laboratory experiments on dogs under ether a rise succeeded by a fall in carotid pressure, a diminution in secretion of the urine and albumen present from very soon after commencement of administration and concludes that ether contracts the renal arterioles and damages the secretory cells of the kidneys - With chloroform and

shows albumen after both ether and chloroform

10  
2x

New York Med. Journal November 1899.  
see Buxton also Kemp



nitrous oxide gas he also found albumen although at a later stage.

Buxton  
disagrees and  
says "none"

2x But Buxton & Levi disagree with Kemp and deny specific ether effects and conclude that such kidney effects are only occasional and are due to excessive quantity of ether circulating in the blood in doses nearly toxic to the vital centres. This paper is the more valuable as including a large amount of clinical evidence carefully recorded. The urine of the patients being tested before operation and for 24 hours after. In 33 cases with no albumen present before operation 32 had none after and only one with a faint trace. In two cases with albumen before operation none was found after. In one case with albumen present before a slight increase was found after operation - The chloroform cases with albumen present before, showed more increase than the ether cases. Even in kidney operations they did not find an increase under ether administration.

from clinical  
evidence,

if present before  
may disappear,

or slight  
increase.

They find diminution  
in water of urine

They find a diminution in the amount of urine secreted and attribute this to abstinence from fluids before and after operation, previous purging incidental to pre-operative routine, diminished blood pressure due to surgical shock and occasionally reflex inhibitory action on the Kidney as in haemorrhoid operations etc. They insist that the reduction is

2x British Medical Journal September 1900.

but solids  
increased as  
shown by sp. g.

only in the watery element, the solid constituents not being seriously affected as shown by increased specific gravity.

No deleterious effects on kidney

They explain Kemp's conclusion as an ischaemia.

Or due to "soaking" or over-dosing with ether.

My own record at variance with this; so further testing with same result.

and certainly "not over-dosed"

In fact they find that ether exerts no deleterious effect on the kidney parenchyma-- They explain away Kemp's conclusions on dogs as due to indirect action of the anaesthetic, producing an ischaemia of the kidney by being pushed to an excessive degree. The case that these authors make for ether is a very good one so far as any evil effect to the kidneys are concerned. They conclude that no albumenuria or ischaemia should occur if the patient be not "soaked" with ether and that any such result is due rather to the abuse than the use of ether in anaesthetization. In any case it is transient in effect.

As will be seen my own experience does not agree entirely with the results arrived at by Buxton and Levi. Of the records I have, fully a 100 cases were noted before the appearance of Buxton and Levi's paper but finding these so much at variance with their observations I almost doubted whether some error had not crept into our mode of testing, for of one thing I felt confident that the patients whom I anaesthetised "were not soaked" with the drug, as I have

always made it my study to keep the patient just sufficiently under and no more, therefore I have since then, during this last two or three months, instituted a fresh examination of the urines of patients before and after operation and do not find any considerable difference in my results.

Tests used The test on which I relied being boiling, acidulating with a few drops of acetic acid, and not finding the cloud to disappear boiling again, and again acidulating with 10 or 15 drops of Acetic Acid, boiled again for confirmation. Often the amount of albumen was too small to be easily demonstrable by the contact method with Nitric Acid in the cold, but the above ought to exclude the possibility of the cloud being nucleo-proteids or mucin. I am not sufficient of a physiological chemist to distinguish the particular form of albumen found present, but have no doubt of its presence, and have had it confirmed by at least two other medical examiners beside Dr. Macrae and myself. Besides, the same tests were applied before operation to decide the presence or absence of albumen.

I am certainly not interested to prove that ether was the cause, it may have been due to the operations, for it must be remembered that the

x <sup>4</sup> Frederick Hewitt. "Anesthetics"

majority of the cases viz. 56 per cent. were abdominal sections often involving considerable manipulation and exposure of viscera. In very few cases indeed and these were incidental to the operation, that is kidney cases and hysterectomies did I find blood by the <sup>u/</sup>guaiacum and Ozonic Ether test.

I quite agree as to increased specific gravity of the urine passed after ether anaesthesia. I have almost invariably found abundant eithates present.

Bronchitis, etc.  
as an after result  
infrequent,

With regard to the occurrence of bronchitis, broncho-pneumonia, or pneumonia, after ether anaesthesia, as I have already mentioned there has been  
x as Hewitt remarks, "undoubtedly gross exaggeration." He says in that ten years he has only seen two cases undoubtedly due to the anaesthetic, and although I would confess to having seen more than this number following anaesthesia and operation yet I do not think many could be with any justice really attributed to the anaesthetic and it must be remembered that in all cases, unless there be marked contra-indications ether has been our routine drug. Lately, since our adoption of dry sterilised towels instead of wet carbolic and of gamgee coverings for the body and limbs, I should just as soon expect bronchial troubles to follow, in consequence of ether giving, as sepsis to succeed a rigorous Listerism or the observance of

and doubtful if  
due to ether.

Certainly should  
not follow

a strict aseptic routine.

## THE ANAESTHETICS COMMITTEE REPORT.

Since writing this thesis, the report of the Anaesthetics Committee, of the British Medical Association has appeared, and perhaps it is only right, that I should compare my own experience with the conclusions arrived at by that body. At least to such extent as I am able, for unfortunately, I have not kept any such exact record throughout these past eleven years as would enable me, to make the comparison a thorough one.

Comparison with  
my own experience.

My own total about  
equal to the  
Committee's

The total number of cases in which I have administered ether will probably amount to the total number recorded by the Committee under Ether alone, and although among mine some hundreds have not had ether simple, from start to finish, that is to say, sometimes it has been preceded by gas, or by chloroform or a mixture of C & E. yet the great preponderance of the cases have been ether alone, and in the others the amount of chloroform given has been so insignificant to the proportion of ether that for all practical purposes I have considered them as properly comparable to the conclusions arrived at by the Committee under Anaesthetic No. 2 (that is Ether simple.)

No deaths among  
my cases.

Of danger cases  
few and in no  
immediate danger  
of dying.

Methods adopted

First as regards ether cases, falling under the Column "cases of danger including death". I have no case of death to record neither during the operation nor within some considerable time thereafter, say twenty four hours; none at all in which the patient did not recover thoroughly from the anaesthetic, so that I have been much more fortunate than the average anaesthetist who has reported to the Committee, for although "of the ether deaths reported, not one is held to be due entirely to the anaesthetic" yet the Committee have judged it right to put three deaths against Ether, as at least contributory. Of those cases in which there seemed a danger of the patient dying, I suppose that I must have had a certain number, but as I have already said, not having unfortunately a complete record, I am unable to say how many, or rather how few, for my clear impression of all my experience is, that at no time did a patient ever seem to me in imminent danger of dying, although I have had many alarms. Certainly no case I have ever had, required more urgent treatment than the pushing forward of the jaw, pulling forward of the tongue, raising the lower end of the couch, or resort to artificial respiration for a very short period indeed, I mean a few artificial expiratory and inspiratory movements, and occasionally a Strychnine injection. On several occasions intra-venous saline

and in case of shock.

transfusion has been required and more recently, sometimes saline injection into the cellular tissue has been resorted to in debilitated patients, or where there has been considerable haemorrhage or shock but in none of these latter was the anaesthetic in any sense the cause.

Patients usually in fair condition no doubt, and seldom emergency cases,

Of course it must be remembered that in the great bulk of the cases in which I have administered ether, the patients have been in fairly good condition none of them being hospital patients and only but a small proportion emergency cases and thus one would naturally expect much better averages than could reasonably be looked for from the hospital anaesthetist, besides the anaesthetics were in the great majority of cases administered for one surgeon, and that a most able, rapid and dexterous worker, (Professor Mayo Robson) so that this also has its bearing in making comparisons between my own, and those of other anaesthetists giving ether for a promiscuous number of operators.

and surgeon a rapid worker,

(2) As regards the best method of administration of ether I have already given my views and from my own experience could wish for no better, and that is using the Clover with the bag when necessary and without it when possible.

Clover always used with or without the bag.



As regards "Clinical evidence regarding Anaesthetics generally" I agree with the Committee, that (VIII) complications and dangers are more commonly manifested in males than in females, most of the alarms that I have had have been in operations on male patients, but concerning (IX) I have on the contrary always found old people to take ether well and (XI) I disagree with the Committee so far as ether is concerned that danger to life is especially likely to be incurred at an early part of the administration, in fact it is seldom that we wait for deep anaesthesia before beginning the operation. As regards (XII) that "the tendency for complications dangerous and otherwise to occur increase pari-passu with the gravity of the operation", in so far as during the last seven years, the greater number of the administrations have been for grave operations, this would still further argue for the safety of ether so far as my experience goes.

With "the general" conclusion of the "Sub Committee" that by far the most "important factor in the safe administration of anaesthetics is the experience which has been acquired by the administrator," I entirely agree, but I do think that the safety is much greater with ether and the danger much greater with chloroform, no matter what the experience of the

anaesthetist may be, no matter what care and watchfulness he brings to its administration.

I have tried throughout this paper to argue fairly, neither unduly extolling ether as an anaesthetic nor depreciating chloroform. But I feel convinced that the anaesthetist who becomes expert with ether will never care to use its rival unless in the cases, and those I hold to be very few, where ether is altogether inadmissible on account of the kind of operation or unsafe from the presence of existing bronchial trouble, phthisis, pressed-upon or narrowed air-passages, or in some such equally <sup>operative</sup> rare conditions.