BLOOD CONCENTRATION AND BODY TEMPERATURE IN ANÆSTHESIA

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In a recent communication data were presented which show, firstly, that dogs under the influence of ether maintain their normal body temperature only when the temperature of the surroundings is very near to 31°C. in either wet, or dry, gently fanned atmospheres; secondly, that irrespective of environmental conditions, ether always causes blood concentration; and thirdly, that when water or hypo-tonic solutions are administered prior to ether the blood concentration is markedly reduced, but body temperature is lowered.

In an attempt to conserve concomitantly the normal levels of blood fluidity and of body temperature it was decided to conduct a series of experiments with a further reduction in the cooling power of the environment, using dogs which had had liquids. The temperature chosen was that of 33°C. In all other respects the conditions and methods were identical with those previously described. The results are set forth at Table I. It may be seen that there is a better maintaining of body temperature than that at the previously reported optimum, and this is accompanied by variable slight increases in the blood solids.

It is worthy of note that in experiments Nos. 21 and 22 water was given by mouth, and in each instance there was not only good maintaining of body temperature but also minimal blood concentration. (These facts compare well with those of

1. From a paper read before a meeting of the Canadian Society of Anæsthetists at Ottawa, June 17th, 1924.
experiments previously reported in which water alone was used hypodermically.\textsuperscript{1)}

It may be mentioned that chloroform was the anaesthetic employed in experiment No. 22, and here there were neither changes in body temperature nor blood solids.

**TABLE I.**

**Effects of Ether or Chloroform at 33°C. Dry Air after Administration of Fluids.**

<table>
<thead>
<tr>
<th>Expt. No.</th>
<th>19</th>
<th>20</th>
<th>21</th>
<th>22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluid (one hour before anes.)</td>
<td>3% Dextrose</td>
<td>3% Dextrose</td>
<td>Water</td>
<td>Water</td>
</tr>
<tr>
<td>Avenue</td>
<td>Subcutaneous</td>
<td>Subcutaneous</td>
<td>Stomach</td>
<td>Stomach</td>
</tr>
<tr>
<td>Temperature °C. of chamber.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry bulb</td>
<td>33.0</td>
<td>32.6</td>
<td>33.0</td>
<td>33.0</td>
</tr>
<tr>
<td>Wet bulb</td>
<td>22.8</td>
<td>22.7</td>
<td>21.1</td>
<td>21.4</td>
</tr>
<tr>
<td>Kata-thermometer mil. cal. per sq. cm. per sec.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry</td>
<td>.82</td>
<td>.80</td>
<td>.75</td>
<td>.96</td>
</tr>
<tr>
<td>Wet</td>
<td>9.8</td>
<td>8.4</td>
<td>8.8</td>
<td>9.8</td>
</tr>
<tr>
<td>Temp. °C. of animal before fluid</td>
<td>38.3</td>
<td>38.0</td>
<td>39.55</td>
<td>38.2</td>
</tr>
<tr>
<td>Temp. °C. of animal after fluid</td>
<td>38.8</td>
<td>38.2</td>
<td>39.0</td>
<td>37.95</td>
</tr>
<tr>
<td>Temp. °C. of animal after ether and one hour in chamber</td>
<td>38.7</td>
<td>37.0</td>
<td>39.1</td>
<td>38.2</td>
</tr>
<tr>
<td>Net change from normal</td>
<td>+0.4</td>
<td>-1.0</td>
<td>-0.45</td>
<td>0.0</td>
</tr>
<tr>
<td>Blood solids per cent. before fluid</td>
<td>22.3</td>
<td>22.6</td>
<td>18.5</td>
<td>21.0</td>
</tr>
<tr>
<td>Blood solids per cent. after fluid</td>
<td>22.1</td>
<td>23.4</td>
<td>17.5</td>
<td>20.6</td>
</tr>
<tr>
<td>Blood solids per cent. after one hour ether in chamber</td>
<td>25.1</td>
<td>24.7</td>
<td>19.8</td>
<td>21.0</td>
</tr>
<tr>
<td>Net change from normal</td>
<td>+2.8</td>
<td>+2.1</td>
<td>+1.3</td>
<td>0.0</td>
</tr>
</tbody>
</table>
TABLE II.
EFFECTS OF MORPHINE-ETHER AT MODERATELY INCREASED ROOM TEMPERATURE (ABOUT 25°C).

<table>
<thead>
<tr>
<th>Expt. No.</th>
<th>24</th>
<th>25</th>
<th>26</th>
<th>27</th>
<th>28</th>
<th>29</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature °C. of chamber.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry bulb ... ... ...</td>
<td>24.95</td>
<td>25.7</td>
<td>25.5</td>
<td>25.2</td>
<td>25.0</td>
<td>25.2</td>
</tr>
<tr>
<td>Wet bulb ... ... ...</td>
<td>15.3</td>
<td>15.1</td>
<td>16.8</td>
<td>15.6</td>
<td>13.6</td>
<td>13.8</td>
</tr>
<tr>
<td>Kata-thermometer mil. cal. per sq. cm. per sec.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry ... ... ... ...</td>
<td>3.1</td>
<td>2.8</td>
<td>2.9</td>
<td>3.25</td>
<td>2.88</td>
<td>3.78</td>
</tr>
<tr>
<td>Wet ... ... ... ...</td>
<td>13.1</td>
<td>13.6</td>
<td>12.7</td>
<td>12.29</td>
<td>13.77</td>
<td>13.77</td>
</tr>
<tr>
<td>Temp. °C. of animal before morphine ... ...</td>
<td>38.3</td>
<td>38.2</td>
<td>38.15</td>
<td>38.6</td>
<td>38.5</td>
<td>38.5</td>
</tr>
<tr>
<td>Temp. °C. of animal after morphine (one hour) ...</td>
<td>38.0</td>
<td>37.0</td>
<td>38.15</td>
<td>37.3</td>
<td>37.5</td>
<td>37.7</td>
</tr>
<tr>
<td>Temp. °C. of animal after ether (one hour) ...</td>
<td>36.3</td>
<td>36.8</td>
<td>37.0</td>
<td>36.5</td>
<td>36.4</td>
<td>36.5</td>
</tr>
<tr>
<td>Net change from normal ...</td>
<td>-2.0</td>
<td>-1.4</td>
<td>-1.15</td>
<td>-2.1</td>
<td>-2.1</td>
<td>-2.0</td>
</tr>
<tr>
<td>Blood solids per cent. before morphine ... ...</td>
<td>19.3</td>
<td>21.5</td>
<td>19.7</td>
<td>22.5</td>
<td>23.5</td>
<td>24.7</td>
</tr>
<tr>
<td>Blood solids per cent. after morphine (one hour) ...</td>
<td>20.5</td>
<td>24.7</td>
<td>21.2</td>
<td>22.5</td>
<td>22.6</td>
<td>23.6</td>
</tr>
<tr>
<td>Blood solids per cent. after one hour ether ... ...</td>
<td>20.5</td>
<td>24.8</td>
<td>21.3</td>
<td>23.1</td>
<td>23.8</td>
<td>24.3</td>
</tr>
<tr>
<td>Net change from normal ...</td>
<td>+1.2</td>
<td>+3.3</td>
<td>+1.6</td>
<td>+0.6</td>
<td>+0.3</td>
<td>+0.4</td>
</tr>
<tr>
<td>Net change after ether from morphine ... ...</td>
<td>0</td>
<td>+0.1</td>
<td>+0.1</td>
<td>+0.6</td>
<td>+1.2</td>
<td>+0.7</td>
</tr>
</tbody>
</table>

The lowered cooling power of the environment may be seen from the recorded Kata-thermometer figures, namely, 0.8 dry and 9.2 wet.

The previously expressed view, that during anaesthesia some of the water which leaves the blood may go to the tissues, is strengthened by the results of other work done in this laboratory on rats, when it was found that after ether anaesthesia the water content of the muscles was increased.

Attention was now turned to the effects on body temperature and blood concentration when morphine is administered before ether.

These observations were made in the same constant temperature chamber at a temperature of approximately 25°C. Morphine sulphate 10 mg. per kilo was administered hyp-o-
dermicafTy one hour before etherization. The results are given in Table II. It will be seen that whereas morphine at this environmental temperature over a period of one hour causes only a slight fall of body temperature the superposition of ether anaesthesia is accompanied by a marked fall in temperature.

The changes in blood concentration are remarkable in that morphine, with one exception, causes very slight changes in percentages of solids in the blood within an hour, and after ether is administered the usual increase in blood solids is almost completely offset.

It is difficult to understand the exception mentioned above, namely, that of experiment No. 25, in which there occurred marked blood concentration after morphine, and all the more so seeing that the same dog was used at experiment No. 29 when there was practically no change in the blood solids. This morphine-ether effect is all the more interesting when considered along with the fact that it has been found in this laboratory that morphine-ether anaesthesia produces a much greater degree of hyperglycaemia than that of ether alone, which confirms our belief that glucose should not be given before, during or immediately after ether or chloroform.

CONCLUSIONS.

1. With an elevation of the environmental temperature to 33°C, accompanied by the administration of fluids, there result negligible changes in either body temperature or blood solids in anaesthetized dogs.
2. Morphine administered prior to ether protects the animal against blood concentration.
3. For etherized dogs the optimum "dry" and "wet kata cooling power" of the environment lies near 0.8 and 9.0 millicalories respectively when fluids are administered.

REFERENCES.

SCOTTISH SOCIETY OF ANÆSTHETISTS.

The Annual Meeting of the above Society was held at the Royal College of Surgeons, Edinburgh, on 17th May, 1924.

Dr. FAIRLIE read his Presidential Address on the subject of ANÆSTHESIA, ITS PRESENT POSITION.

We have had many papers on particular aspects of anaesthesia at the meetings of this Society, but we have not had for some time, if ever, any attempt at a general survey of the subject. On having the honour of President conferred upon me I thought, therefore, that the more general aspects of our science and art might be made the subject of my remarks, with special attention to the more recent developments. Whatever subject I chose I was faced with the difficulty of saying anything of real interest and value to the Society. Therefore, in deciding on this subject, and especially in commenting on recent developments, I have sought rather to give my own personal expression of opinion on aspects and methods of which I myself have had experience, than to read extracts from recent literature with which you are all probably more familiar than I am. I quite realise the dangers of this course and apologise for the inadequacy of my treatment. I have no doubt you will discover many serious omissions, and, on the other hand, undue emphasis on certain points which do not deserve it.

I thought that the subject might very well be introduced with a consideration of the position and status of the anaesthetist. While in London the administration of anaesthetics has been more or less in the hands of the specialist since soon after the discovery of the anaesthetic properties of ether and chloroform, such names as Clover and Snow being sufficient reminders of this fact, in Scotland the specialist is of more recent origin. Up to very near the end of last century few, if any, turned their attention in any special way in that direction. Perhaps the reason lay in lack of encouragement. The surgeon depended, to a considerable extent, for the anaesthesia of his patient, on assistant, house surgeon, or the general practitioner in charge of the particular patient on whom he was operating. Whatever the reason, this custom prevailed very generally in Scotland till about 25 or 30 years ago. I cannot speak for Edinburgh or any of the other centres in Scotland except Glasgow, but in the latter city I believe Dr. Henderson, father of one of our members, was the first to make any attempt to specialise in anaesthetics. With the amazing developments which have taken place in surgery during those years
the demands on the administrator of anaesthetics has grown, and as a
result, the need for the expert has become more and more urgent,
until now he (or she) has a very definite place in every surgical
centre. As far as we can judge this place is likely to remain estab-
lished so long as surgery is practised, or until a better method of
allaying pain is discovered. Established then, as a definite entity in
medicine, the anaesthetist in Scotland can regard with satisfaction
the improvement which has gradually taken place in his lot. It has
taken time for the old idea to be uprooted, that anyone who happened
to be at hand was good enough to give an anaesthetic.

No doubt there is still room for improvement in certain directions.
Our discussion of a year ago, on the perhaps sordid but very vital
question of ways and means, bears testimony to that. Another
direction in which improvement would be welcome to many of us is
in the information vouchsafed to us in the booking of appointments.
It is hardly justice to patient, surgeon or anaesthetist to have the
bare fact of an appointment at a certain time and place communicated.
There is a considerable difference in the methods required for
anaesthetising, say, a whitlow, a cholecystitis, a goitre, and a cleft
palate. An indication as to the nature of the operation to be per-
formed would be a great help to all concerned.

On coming to the consideration of the anaesthetics at our command
I am not in a position to venture an opinion on the value of such
recently introduced anaesthetics as acetylene and ethylene, and will
confine my remarks to those which have been in more general use,
glancing at the newer methods of administering them. On the old
controversy on the respective merits of ether and chloroform I do not
intend to say much. Judging from recent contributions to medical
literature it is as lively in its old age, or shall I say middle age, as
it was in infancy. I am not one of those who considers chloroform
a back number, though, on the other hand, I do not look upon it as
the routine anaesthetic. No more do I adopt ether as a matter of
course. My choice of anaesthetic, whether ether, chloroform, or other
drug, depends on the exigencies of the particular case.

There are three points in connection with chloroform on which I
should like to touch:—

(1) I do not go with such writers as Flagg who says in his recent
edition of "The Art of Anaesthesia": "In the author's experience,
chloroform has completely given way to ether administered by intra-
pharyngeal methods. This condition holds with the single exception
of oral cases in which the actual cautery is used." If it is to be used,
however, it should be done with very great circumspection, and, in
my opinion, by some form of dosimetric apparatus which controls the
vapour strength, so that it may be given evenly, and not in widely
and rapidly changing percentages. Levy's work has amply stressed
the importance of this, though it seems to me he under-estimated
the part played by actual over-dosage in chloroform collapses and fatalities.

(2) It should not be given at all in acute sepsis, particularly of the abdomen, because of the risk of acidosis.

(3) It should not be used except by the expert. Adequate anaesthesia can be maintained, and anaesthetic mortality considerably reduced, by a more general employment of open ether, in the hands of house surgeons and those who only occasionally give anaesthetics.

In turning to ether, so many new methods and appliances have been introduced that it is almost impossible to keep up to date. To me the most valuable innovation in giving "open" ether is the perhalation method which Dr. Ogston described to us two years ago. It combines in a marked degree simplicity and efficiency. A slight modification of it which I find most useful is to combine it with the Bomb method of Wilson and Pinson, leading the tube from the bomb between the layers of gauze in Ogston's mask, and thus introducing warmed vapour instead of dropping liquid ether on to the gauze. In addition to the advantage which the warm vapour gives, there is also the freeing of the hand which is usually occupied with the drop bottle.

Shipway's apparatus for warmed chloroform and ether vapours I find invaluable in face, mouth, and nose operations, where a mask is inconvenient to the surgeon. I use it mostly as an ether inhaler, but find it convenient to have chloroform at hand to deepen the anesthesia when necessary. Rectal anaesthesia, using Gwathmey's ether oil mixture, I have found of great service in laryngoscopic and bronchoscopic examinations.

The method which I have found the greatest advance in the science of anaesthesia is the intra-tracheal method, either with ether or chloroform. It has not been my privilege to handle a Mott's apparatus which I should imagine to be the last word in perfection, but even with less perfect appliances the gain over other methods, in certain cases, is very marked; admittedly in certain cases, for it has not been recommended as a routine method. The confidence which it inspires both in surgeon and anaesthetist in four classes of operations is of a nature that no other method achieves. These four classes are:

(1) Extensive face and intra-oral operations.
(2) Removal of goitres or other tumours about the neck.
(3) Lung surgery.
(4) Any operation entailing awkward positions for the patient.

Although gas and oxygen has been used for anaesthesia for over fifty years, its vogue has greatly increased lately. With the introduction of sight-feed appliances and accessory ether or chloroform bottles, it has been possible to administer it much more successfully than by the older methods. Like many other anaesthetics which have from time to time been hailed as the introducers of a new era,
it has suffered a rather severe eclipse lately, and the pendulum has swung over to the other extreme. We have all, no doubt, read very scathing criticisms of gas and oxygen recently. Probably opinion will eventually take up a position between the two extremes. Gas and oxygen anaesthesia has very definite limitations, but having strict regard to those it makes an almost ideal anaesthetic in its own field. Administered after preliminary narcotics, with rebreathing, and with the minimum of ether or chloroform, it possesses very pronounced advantages in operations where a great degree of muscular relaxation is not demanded. Even in the latter class of case more use may well be made of it provided the surgeon is prepared to use novocain locally in the tissues of the abdominal wall.

I do not restrict the use of oxygen to its accompaniment of nitrous oxide. My inclination is to use it more and more along with ether and especially chloroform. The underlying idea is the same in each case. Any mixture of anaesthetic vapour and atmospheric air suffers from the high proportion of nitrogen. If the need for deep anaesthesia arises this acts as a handicap. In other words, anaesthesia may be pushed further, with a greater degree of safety, in presence of a higher proportion of oxygen than the atmosphere contains. So in abdominal operations, particularly those of the upper abdomen, I frequently find a stream of oxygen led under the mask of great assistance. It prevents the onset of cyanosis with accompanying rigidity. It is useful in any operation where the patient, for one reason or another, has a tendency to cyanosis.

In bringing this brief review to a close there are certain important omissions for which I must give reason. I have said nothing about nitrous oxide administered alone, nor ethyl chloride, not because I do not use them, but because I have nothing of any special interest to say about them. Then I have touched very slightly on special methods for anaesthetising in oral and nasal operations, lest I should trespass on the ground which Dr. Gibbs is about to traverse in his paper. For this reason I have omitted entirely any reference to continuous nasal gas. And lastly I have made no reference to spinal anaesthesia from the feeling that it would introduce too large a subject and one which deserves a paper to itself.

At the conclusion of Dr. Fairlie's paper a discussion followed.

Dr. J. S. Ross thought it was important that the administration of chloroform should not become a lost art and that it should be adequately taught to students. With regard to rectal anaesthesia he considered that if surgeons would inform the anaesthetist in advance of patients who were terror-struck, rectal anaesthesia might have a wider field of usefulness. He was glad to hear Dr. Fairlie's remarks with regard to the use of oxygen apart from nitrous oxide and oxygen. He considered that no theatre was properly equipped if it did not contain an oxygen cylinder with oxygen in it. It was absurd for
The anaesthetist to have to carry an oxygen cylinder to large nursing homes for his personal use. With regard to nitrous oxide and oxygen he considered its dangers lay in attempting to handle with it patients of too powerful a type, and in being ashamed to use adjuvants such as ether or even chloroform in low percentage strength, for a brief period. Recently he had used in his ether bottle a mixture of ether 90 per cent. and chloroform 10 per cent., and found that he got much quicker control of the patient, and had improved his results very much. Many years ago he had personally experienced a death under nitrous oxide and oxygen which he was now satisfied would not have occurred had he made more use of adjuvants and thus avoided any necessity for undue oxygen deprivation.

Dr. Ross MacKenzie (Aberdeen) agreed with previous speakers that students should be adequately instructed in the administration of chloroform. He would go the length of giving alternate ether and chloroform cases when teaching students. At the Sick Children's Hospital, Aberdeen, the majority of cases were conducted under nitrous oxide and oxygen, combined with very careful use of novocain infiltration. This combination in his experience covered the largest field in children. An unusually high proportion of oxygen was necessary and a mere trace of ether vapour during the induction period. There was very little after-sickness and a very rapid recovery. He had used rectal ether a good deal in children and liked the immediate results, but the method threw a good deal of work on the nursing staff, and the surgeons were inclined to think that there was more after reaction than with the inhalation method.

Dr. Ogston (Aberdeen) believed that very good results could be got with gas-oxygen combined with novocain infiltration. He thought the best relaxation was obtained by blocking the intercostal nerves as they emerged from the lower spaces. He wondered whether the drugs now available were as good as those we had pre-war; the results did not seem quite so good.

Dr. Johnston (Aberdeen) agreed as to the value of oxygen given with any anaesthetic. It was particularly useful when using ethyl chloride as a preliminary to open ether sprayed on the mask. There was apt to be some cyanosis just as the patient was going under, and a whiff of oxygen at this stage was very beneficial. He had used rectal anaesthesia for operations about the mouth and nose, but was now rather shy of it, as he had experienced a good deal of after-sickness.

Dr. Mills (Dundee) did not agree as to the teaching of chloroform to students. It was far more important to teach them its dangers, and to get them accustomed to other methods. As regards intra-tracheal he thought that in many nose and throat operations its place could well be taken by intra-pharyngeal ether, if the surgeon were careful to mop blood out as he went along.
Dr. J. S. Frew (Glasgow) confirmed the value of oxygen with anaesthetics other than nitrous oxide.

Dr. F. L. Napier (Glasgow) had come to rely very largely on the Shipway apparatus, using a trace of chloroform with the ether. He used oxygen gas to bubble through the ether instead of air.

Dr. Barras (Glasgow) agreed with Dr. Napier. He, however, had a side tube direct from the oxygen cylinder to the patient for use in emergencies. Where malignant disease was present in the mouth he avoided intra-tracheal if possible, as he considered it quite a possibility that the catheter might carry infection down into the lung.

Dr. Torrance Thomson considered it certain when out in the world young practitioners would use chloroform very freely and he therefore considered it essential that in their student days they should be taught it. He used oxygen both with open and closed ether and had found Pinson's oxygen valve of great value. He was a warm advocate of the use of the intra-tracheal method for abdominal sections, particularly for a high operation such as gall bladder. He had had good results with nitrous oxide and oxygen given by this route but found it very expensive. He had had very good results with ethenesal but upon the whole he doubted whether it was really any better than a good brand of ether. For some months he had been using the Pinson Bomb and regarded it upon the whole as the best method for open ether.

Dr. Logan Turner expressed his appreciation of the invitation to him by the Society to attend the meeting and join in the discussion. He had always favoured the closest co-operation between various specialists and certainly between the surgeon and the anaesthetist. He quite agreed that the anaesthetist should be informed precisely of the nature of the case and of all relevant points in connection with it as soon as the appointment was made. In these days he had found very often that the anaesthetist's preparations required to be as complicated as or more so than those of the surgeon.

Dr. Fairlie thanked the Society for the reception given to his remarks. With regard to the teaching of the students he personally favoured a deliberate attempt being made to wean the new members of the profession altogether from the habitual use of chloroform and thought therefore that in teaching all the emphasis should be laid upon the simpler methods of giving ether. He agreed with Dr. Thomson that ethenesal had no advantages over a good brand.

Dr. J. H. Gibbs opened a discussion upon "Methods of Anaesthesia in Nasal, Dental and other Oral Operations." He explained that he would simplify his remarks by speaking mainly of the methods which he personally used and would exclude mostly from his observations the question of individual peculiarity in the patient, considering the anaesthetic solely in connection with the locality or disease to be dealt with and not with any constitutional complaint such as cardiac.
or pulmonary disease. Mouth and nose operations had this peculiarity that the interests of the surgeon and anaesthetist in many cases seemed to clash; each wanted to get at the patient at the same time. If ether was to be given he insisted upon a preliminary dose of atropin. One hundredth of a grain was usually an adequate dose. If haemorrhage was not likely he added heroin or morphia. Upon the whole he thought that heroin gave less after effects. His stock method for longer cases, such as antrum operations, was to induce with ethyl chloride and ether given with the Clover instrument and then change over to a Junker or Shipway, passing the vapour where possible along a catheter through the nose into the pharynx. For tonsils or adenoids in subjects up to 12 or 14 years of age he habitually used ethyl chloride, regarding 4 cc. as the maximum dose. Latterly he had been adding 1 cc. of ether and desired an expression of opinion from other members as to whether this addition increased the safety of ethyl chloride. For enucleation of tonsils, for which ethyl chloride alone would be inadequate, he used the Clover method of ether, getting a forecast from the surgeon as to the length of time which it would be desired the patient should remain under the anaesthesia. Here it was very necessary that the patient should have atropin, but morphia was undesirable. For paracentesis of the antrum nitrous oxide often sufficed. For mastoid operations he induced with ethyl chloride and ether in the Clover instrument and followed up with open ether. For dental work he found that nitrous oxide or nitrous oxide and oxygen as a single dose anaesthetic sufficed for anything up to three teeth as a rule. For cases taking a little longer than this he added 1 cc. of ethyl chloride at the last moment. The patients need only take about five breaths of this, and some 10 seconds or more were thus added to the available anaesthesia. For cases demanding even longer time he used up to 2 or 3 cc. of ethyl chloride. Working on these lines he had given 30,000 administrations of ethyl chloride or ethyl chloride and gas without fatality until recently, when he unfortunately had had a death in the Dental Department of the Royal Infirmary. The patient was sent to him for the extraction of fifteen very septic teeth; she was absolutely panic-struck; he began the anaesthesia by giving her 3 cc. of ethyl chloride by the vapour method; during the early part of the administration she screamed almost continuously; she finally, however, went under, the colour remaining good. One tooth was extracted when a slight amount of pallor and faintness of respiration was observed, the pupil remaining small, and he proceeded, therefore, to take out another tooth. The pallor then increased, and he therefore stopped operating and had her lowered to the floor and commenced artificial respiration. The surgeon on duty was sent for and opened the abdomen in order to give cardiac massage, but by this time the patient was dead and did not respond in any way to the treatment. The patient was known
to have suffered from rheumatic fever but her heart had been thoroughly examined by a physician before the anæsthetic, and was believed to be perfectly sound. Owing to difficulties with the relatives it was most unfortunately impossible to secure an autopsy. It was arguable that this death was mostly due to the delayed effects of fright, but since the occurrence he had resolved always to add 1 cc. of ether to any ethyl chloride which he gave. There could, of course, be no absolute proof that this added to the safety, seeing the infinitesimally small death-rate from ethyl chloride given in the doses that he advocated. He had used nasal gas and nasal gas and oxygen extensively, but found that the ordinary nasal inhaler interfered a good deal with the work of the dentist. He therefore preferred his own appliance, which he showed to the meeting, where the gas was led by tubes into each side of the nose, the anterior nares being plugged by his instrument around the entering tubes. In working with nasal methods he had found great advantages from the use of a large sponge pushed on to the dorsum of the tongue; even with single dose methods he used this sponge, believing that it prolonged the anæsthesia without producing any serious embarrassment of respiration. Small sponges as used by some dentists were dangerous; he had seen a case where a man swallowed two of them and as he was already suffering from slight chronic intestinal obstruction considerable anxiety was felt, but the sponges were ultimately passed safely. He emphasised the danger of anything but a straight sitting-up position for extraction of teeth. He had an extensive experience of intra-tracheal anæsthesia but even now he thought the best results were obtained in malignant diseases of the mouth by doing a preliminary tracheotomy and packing the upper orifice of the larynx.

Dr. Logan Turner said that he personally accepted the position that the anæsthetist as a specialist was entitled to choose the drug and method which should be used, but he pointed out that the law it was the surgeon who was responsible if anything happened. Team work in the class of case under discussion was quite essential. The surgeon and anæsthetist must be accustomed to work together and must have mutual confidence in each other's skill. He was a warm advocate of ethyl chloride given by vapour method for tonsils and adenoids in children (having had over 17,000 cases at the Royal Infirmary with only one fatality in fifteen years), but not adults. He did not consider that by it sufficient relaxation of the muscles of the palate could be obtained to give the operation by the reverse guillotine a fair chance. As anæsthetists from Glasgow were present, he would be glad to know whether it was the case that Dr. Sime habitually performed the operation of enucleation of the tonsils by scissors and snare under ethyl chloride alone. He would also like to know whether bromide of ethyl was still used in Glasgow by Dr. Kelly. Even for ethyl chloride he considered full preparation as for
a major anaesthetic was essential. He had noticed reference in American literature to abscess of the lung following operations for tonsils and adenoids, which might be ascribed either to dropping a piece of tissue down the larynx or perhaps merely to the expression of septic fluids from the tonsil at the moment of removal. He personally had never experienced this sequel, but would be glad to know whether any of the members of the Society had heard of such cases.

The President informed Dr. Logan Turner that he knew that Dr. Kelly did still habitually use ethyl bromide given from a handkerchief; the patient sat up and the head was thrown forward at intervals during the operation to get rid of the blood. So far as he knew no other throat surgeon used the method.

As regards the point between heroin and morphia, he did think heroin produced less after-effects. He had had, however, very good results with "Abbott's H.M.C." preparation of morphia and desired to know whether other members considered this preparation had any special advantages. He had entirely abandoned the old Junker and used the Shipway instrument instead, using mostly pure ether, and in this particular class of case delivering the stream through a No. 10 catheter along the nose into the pharynx. He often used oxygen with the apparatus instead of air. He thought, however, that intrapharyngeal anaesthesia by this method was inadequate in many cases as compared with true intra-tracheal, as one missed the return flow of air. He had no special fear of carrying malignant disease into the lung by the catheter unless the ulcer was very foul, and thought the gain was tremendous over a tracheotomy opening. He agreed that ethyl chloride was inadequate for tonsils and adenoids in adults, using open ether followed if necessary by the Shipway, by nasal tube. For longer dental cases his own practice differed evidently from that in use in Edinburgh, as he made extensive use of nasal gas with air. He admitted that the counsel of perfection was to give it with oxygen, but the question of the weight of the cylinders made nasal gas and oxygen hardly practical politics. He found no difficulty in fitting almost any size or shape of nose with this appliance and did not find that it interfered materially with the work of the surgeon. His apparatus provided for beginning the administration both by the nose and mouth, but anaesthesia was prolonged by the nose alone with considerable plus pressure. He commonly continued it for fifteen minutes, and by the use of an air valve on nose-piece had no difficulty in avoiding serious cyanosis. Admittedly certain cases could not be handled by nasal gas, and he always had a Clover ready. For children under 12, even for dental cases, he found gas, certainly nasal gas, unsuitable, and preferred to rely upon ethyl chloride alone. He regarded 3 cc. as the outside dose for a child and with it had only had one serious fright; the child, however, recovered. If 3 cc. of ethyl chloride was insufficient he preferred to use closed ether.
Dr. J. S. Ross referred to O'Malley's technique for nasal operations, particularly for sub-nasal resection of the septum. Its essentials were the tilting of the head table to an angle of 45°, a pillow placed behind head and neck just down to the upper portion of the shoulders producing a slight flexion of the neck; the use of Phillip's artificial air-way to produce strict oral respiration and a combination of local anaesthesia by packing the nose beforehand and continuing with a very light chloroform anaesthesia. Having worked with O'Malley for a short period during the war he had been struck with the smoothness of events if every one of these details was strictly adhered to. Another point in O'Malley's method was the use of a very deep nitrous oxide anaesthesia for the enucleation of tonsils and adenoids, even in young, strong adults. With regard to dental work he adhered to the method devised by Dr. Guy and himself, which was only an elaboration of the original gas oxygen method devised by Guy. He agreed with Dr. Gibbs that in using any of these methods it was better to produce a deep anaesthesia with gas or gas and oxygen in the first instance, and to use a small dose of ethyl chloride in the last few seconds of the anaesthesia only. He was inclined to think that Guy's original instructions for the anaesthesia were slightly defective in that not enough advantage was taken of the nitrous oxide element before adding the ethyl chloride. None the less, the credit for pointing out the advantages of the combination of nitrous oxide with a very small dose of ethyl chloride as against the method of giving large doses of ethyl chloride alone for dental purposes was certainly due to Guy. With regard to nasal methods, the addition of oxygen enormously simplified the actual administration, but the question of the bulk and weight of the apparatus was so important that he had been specially interested in listening to Dr. Fairlie's experience of nasal gas without special provision for oxygen.

Dr. Frew had himself removed a good many tonsils and adenoids under Kelly's bromide of ethyl method and found it most successful. With regard to septic lung trouble after operation, he had had two personal experiences; one was a lung abscess following the extraction of very septic teeth—no solid-foreign body was ever detected in the lung and the patient eventually recovered. In another case septic trouble followed a piece of bone inhaled during an operation upon the antrum; lung abscess followed, the bone was ultimately coughed up, and here also complete recovery followed.

Dr. Naper, in reply to Dr. Logan Turner's question, said it was the case that Dr. Sime did enucleate tonsils by scissors and snare under a single dose of ethyl chloride.

Dr. Barras considered that the Shipway apparatus overcame most of the difficulties of nose and mouth operations which could not be covered by single dose anaesthetics. With regard to ethyl chloride he used it extensively among children and did not consider that there was in its use any very material after-sickness.
Dr. Torrance Thomson alluded to the impossibility of proving that the addition of ether increased the safety of ethyl chloride; how could you prove it if you had to wait for 30,000 cases before you got your first death after ethyl chloride alone? The further question arose, however, of whether it improved the anaesthesia in type and duration. There is a belief among some people that it does. With regard to tonsils and adenoids in adults he described Rood's method of saturating the patient with ether given from the open mask much overlaid with towels and blankets. In Rood's own hands the results seemed to be excellent. He asked whether Dr. Ross could tell him anything of the posture used by the late Professor Alexis Thomson in certain neck operations.

Dr. Ross said that Professor Thomson used habitually to do all his tongue and neck operations with the patient pulled into a position almost fully sitting up with the neck very much extended. Ether (preferably intra-tracheal) was always used, and the results were excellent, particularly in neck dissections, as the veins were never engorged.

Dr. Logan Turner said he desired to ask two questions before Dr. Gibbs replied: firstly, with regard to O'Malley's method, did Dr. Gibbs consider that adrenalin, used before operation, might be a source of danger when chloroform was given later, and secondly, was it not the case that with intra-tracheal anaesthesia the surgeon was often very much troubled by the return blast of air and ether playing in his face?

Dr. Gibbs replied generally to the discussion. He was of opinion that chloroform should not be given after adrenalin. He considered that the surgeon was bound to get a certain amount of anaesthetic and did not see why the intra-tracheal method should be specially objectionable in that respect. With regard to the sickness after ethyl chloride, he believed that there was a good deal but that it often came on later when the patient had left the dentist's house. Even apart from sickness there was undoubtedly a good deal of malaise and feeling of depression. He therefore gave the smallest dose possible. He desired to emphasise the fact that when in his opening remarks he referred to the Junker he really meant the Shipway.

At the close of the meeting Dr. Torrance Thomson demonstrated the Pinson Bomb and the intra-tracheal apparatus devised for use with it. He also showed Mr. Dott's intra-tracheal apparatus.

J. S. Ross, Acting Hon. Secretary.

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