Experiences with the bichloride of methylene : read before the Medical Society of London, April 20th, 1868 / by Peter Marshall.

With Mr Marshall's kind regards

(14)

EXPERIENCES

WITH THE

BICHLORIDE OF METHYLENE.

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BICHLORIDE OF METHYLENE;

READ BEFORE THE MEDICAL SOCIETY OF LONDON,

APRIL 20TH, 1868.

BY

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TO

BENJAMIN WARD RICHARDSON,

M.D., F.R.S., F.R.C.P.,

PRESIDENT OF THE MEDICAL SOCIETY OF LONDON.

ETC., ETC.

IN ACKNOWLEDGMENT OF MUCH KINDNESS

DURING A LONG CONTINUED FRIENDSHIP, AND

IN ADMIRATION OF

HIS GENIUS AS A MAN OF SCIENCE,

AS WELL AS OF

HIS PRACTICAL QUALITIES AS A PHYSICIAN,

THIS PAPER IS DEDICATED

BY

THE AUTHOR.

EXPERIENCES

WITH THE

BICHLORIDE OF METHYLENE,

AS A GENERAL ANÆSTHETIC.

Mr. President and Gentlemen,

It was remarked by you, Sir, in a lecture I heard you deliver during the past winter, that the study of Anæsthetics was not of single, but of double value to the world: that while it conferred a practice of the most beneficent character, it opened a theory of therapeutics which promised to make the action of medicines a matter of scientific certainty.

As a practitioner, inclined rather to hold by the practice and to follow theory only when it developes the practice, I am bound to say that the experience I have recently had with the Bichloride of Methylene is altogether in favour of the view above expressed; I believe the prediction of Dr. Snow of a coming day, when the fact, whether a chemical agent is, or is not an aænsthetic could be told by the mere reading of the physical characters of the substance is, in fact, now realised.

I have, on a previous occasion, brought forward, casually, some notes of a few cases in which the Bichloride of Methylene was employed, by myself, for general anæsthesia. To-night I propose to take a more extended view of the subject.

A very carefully studied experience with the Bichloride of

Methylene now extending over a period of six months, including sometimes four or five administrations per day on patients of all ages, from the child of nine months old, to persons most advanced in life, enables me to speak, I trust, with some authority, without which I certainly should not be induced to speak at all.

That the Fellows may keep side by side with me, I shall put what I have to say under the following heads:—

1st.—The Induction, that the Bichloride of Methylene was an Anæsthetic.

2nd.—The Physical properties of the Bichloride, as compared specially with Ether and Chloroform.

3rd.—The peculiarities of administration.

4th.—The phenomena of Anæsthesia under the Bichloride.

5th.—Comparison of the phenomena with those produced by Chloroform, Ether, and Amylene.

6th.—Practical inferences and deductions.

THE INDUCTION.

The discovery of the Anæsthetic properties of the Bichloride of Methylene, was purely inductive.

Working by experiment in the group of bodies known as the Methyl series, and of which a table is before the Society, Dr. Richardson first found that Chloride of Methyl is a good Anæsthetic.

Chloride of Methyl is the first departure from marsh gas, in which Chlorine enters to replace one of the molecules of Hydrogen; it is, in fact, the first of the Chlorine series, of what are called Mono-Carbons.

Further on in the series, is Chloroform in which three molecules of Chlorine replace three of Hydrogen; and further still is Chloro-Carbon, in which all the Hydrogen is replaced by Chlorine.

That Chloroform and Chloro-Carbon would anæsthetize was already well known, and when it was discovered that the lighter Chloride of Methyl would cause the same phenomena, a very interesting advance was made. Chloride of Methyl, however, is a gas at ordinary temperatures, and although it is miscible with ether, the compound is unstable; it could only be considered of service therefore by virtue of its teachings in experiment.

The observation led to the enquiry if, a more stable body could be secured in the same series of bodies, some substance intermediate between the gaseous Chloride of Methyl and the heavy Chloroform. If this were possible, there lay in the new agent a substance, which, to the physiologist, was a certain Anæsthetic, possessing many advantages; and very soon the Chemist knowing the want responded to it by producing the Bichloride of Methylene which answered every expectation to the letter.

PHYSICAL CHARACTERS OF THE BICHLORIDE OF METHYLENE.

The Physical characters of the Bichloride of Methylene and its differences from Chloroform are shewn in the table.

From having in its composition one molucule less of Chlorine and one more of Hydrogen, it is necessarily a lighter body than Chloroform, in the proportion of 1-Hydrogen to 35-Chlorine. The theoretical boiling point is 88° Fahr., but the actual boiling point is a little higher, viz., 94. This same difference between the theoretical and actual boiling points appertains to all the series of volatile fluid substances, used as anæsthetics. No two specimens of Chloroform boil at the same temperature, and, indeed, the same specimen of Chloroform if kept a few months, will yield ebullition at different degrees of heat.

In the best Ether the variation is commonly six and even seven degrees, in Amylene the range is even more remarkable. I do not pretend to explain the cause of these facts, but they are facts of practical interest, extending as it seems to me, to all the easily volatile fluid bodies, and separating them from the more stable fluids such as water.

The specific gravity of Bichloride of Methylene, is 1.344 as compared with water, and the specific gravity of the vapour is 42.5. as compared with Hydrogen. How far as a fluid, and as a vapour, it is lighter than Chloroform or Chloro-Carbon, the table shews.

Substances.	Composition.	Fluid Density, Water=1.	Vapour Density, Hydrogen=1.	Boiling Point, Fahr.	
Marsh Gas . .	C H 4	. . . .	8	. . .	Burns in Air.
Chloride of Methyl . .	C H 3 Cl	. . . .	25.25	. . .	Do.
Bichloride of Methylene .	C H 2 Cl 2	1.344	42.5	88°	Vapour burns in Air.
Chloroform . .	C H Cl 3	1.495	59.75	142°	Vapour puts out flame.

Compared with Ether, Bichloride of Methylene exhibits the following differences:—Its specific gravity as a fluid is ·624 higher. Ether being .720. The specific gravity of its vapour is 5.5 heavier; Ether being 37. The boiling points of the two may be taken as the same. Chemically speaking, the one (the Bichloride) is as we have seen an organic body of a mono-carbon radical; the other (Ether) is the hydrated oxide of a di-carbon radical—Ethyl.

Compared with Amylene,—the anæsthetic brought out by Snow,—the Bichloride of Methylene, has a fluid specific gravity .685 degrees higher, the specific gravity of amylene being 0.659, taking water as unity. The specific gravity of the vapour of the Bichloride is 7.5 degrees higher, the vapour of Amylene being 35, with Hydrogen as unity. The boiling point is virtually the same. Chemically, Amylene differs in that it is a pure Hydro-Carbon in which there are 5 molecules of Carbon.

From Chloroform Bichloride of Methylene differs, as shown in the table, in the behaviour of its vapour on bodies undergoing combustion. The vapour of Chloroform diffused in air stops active combustion, and even extinguishes a burning taper; the vapour of Bichloride of Methylene, like the vapours of Ether and Amylene, burns when a taper is plunged into it, although the combustion is not very active. There is a decline in this respect of a very decisive kind, from marsh gas to Chloroform: marsh gas explodes sharply, Chloride of Methyl explodes and burns in vapour, Bichloride of Methylene vapour burns only. Chloroform vapour prevents burning.

When the vapour of Bichloride of Methylene is burned in air, the substance is decomposed; the Carbon becoming oxidized is no longer a base or bond of union for the Chlorine and Hydrogen in the uncombined state, and they therefore unite giving Hydrochloric acid as the product.

This fact gives rise to a very beautiful experiment. If we

diffuse vapour of Bichloride of Methylene in a bell jar, and plunge in a lighted taper and burn the vapour, on dropping in liquid ammonia, we produce the white fumes of Chloride of Ammonium, thus demonstrating the presence of the Hydrochloric Acid in the free state as the result of the active decomposition.

Bichloride of Methylene when perfectly pure is of neutral reaction: like Chloroform it is affected by light, but in the dark it remains stable. It is rather sweeter to inhale than Chloroform, and is perhaps a little more pungent, but no complaint to its use is offered from the last peculiarity.. Taking it as a whole, I think the majority of patients like it better than Chloroform in respect to taste and odour.

On the first few whiffs a short cough is sometimes excited, but this quickly passes away, and need never, in the administration, create either surprise or alarm.

THE PECULIARITIES OF ADMINISTRATION.

It was at first supposed that Snow's inhaler would answer all the purposes of administration of the Bichloride of Methylene, but it was soon found in practice to be not at all compatible with the requirements of this Anæsthethic. I tried the inhaler in one or two cases, but soon gave up its use.

I prefer a simple mouthpiece invented by our President, as it is easily used and never can get out of order. It consists of lattice work, such is as used for the ornamentation of flower pots, covered by demette or some other porous material, this is again covered round the outer side by parchment paper, excepting on each side where there is a small triangular space to admit air.

The upper part of the cone is left covered merely with the

demette in order to admit of the free access of air, this instrument admits of considerable extension and is pliable.

I generally pour only about half a drachm of the anæsthetic into this mask, at the first commencement of the inhalation, so as to get the patient gradually accustomed to the slightly pungent odour and taste of the anæsthetic: one or even two drachms then are introduced. I know that the President prefers to use the latter quantity in operations requiring only a short time for their performance; but when prolonged anæsthesia is required, to begin with one drachm is a practice on the safe side.

The President afterwards gave a design for an instrument to Mr. Foveaux of the firm of Weiss & Co., which instrument I now hand round: it consists of a mask covering the mouth and nose, the inside being laid over with lint or other porous substance on which is projected the Methylene, by aid of the hand bellows, in the form of a spray. The quantity of the anæsthetic is easily regulated and economised.

Dr. Junker has also invented an instrument for Methylene, it consists of a mask connected with a bottle and bellows, but in this instrument the Methylene is vapourised in the bottle, and the vapour only is driven into the mask. It has been used a great many times with success.

But as I am desirous of being guided by facts gained from experience, I give my decided preference to the simple mouth-piece first named: it is very manageable, it is very certain, and is as simple as a sponge: it can be adapted to all sized faces, it can be kept spotlessly clean and patients look upon it with less dread or dislike than they do on more complicated instruments; the only objection to it is that a little Methylene is lost; but the operator gains control by practice. I have narcotised for the deepest operations with *three* drachms, and in an amputation of the thigh performed by Mr. Hancock last Saturday, not one drachm more was called for. It seems to me therefore, unnecessary to put forward the question of expense as a plea, and the only plea, for a more complicated apparatus.

In infants and young children I have generally used a small cup-shaped sponge, which is likewise useful in operations on the face and jaw; or a piece of circular wire on which is stretched a layer of lint; this little appliance can be interposed between the hands of the operator over the nostrils or mouth of the patient to keep up the effect of the anæsthetic.

I would dwell a little more at length on the mode of administration in relation to the character of the operation to be performed. There is ample field here for learning, or for acquiring by practice a reliable—I had almost said absolute—knowledge of principles: and, although a man will best learn for himself, it may assist all, if I state what I have observed.

Supposing then that the operation is a short one, the extraction of a tooth, the eversion of a toe-nail, the section of a stricture, or other similar process requiring seconds only for its performance, it is merely necessary to administer the Bichloride rapidly and freely for the space of a minute or two minutes at most. It is not requisite to drive it on to produce prostration, nor even the stage of active excitement, or what is known as the second stage of narcotism.

Neither is it necessary to watch the eye for the turning up of the ball, which is so characteristic of profound insensibility; all that is necessary is to seize the moment indicated by the anæsthetizer, and to let the operator proceed; the patient may be talking an instant before, and recognising partially what is progressing, and yet will not feel.

In illustration of this point I may refer to a case in which, in three minutes from the commencement of the administration, Mr. Hasler Harris was enabled to extract painlessly eleven teeth. He had previously extracted three in one minute, from the commencement of applying the anæsthetic, in the case of another patient. In such instances the recovery is as rapid as the insensibility, and in four or five minutes the patient is able to walk from the operating room.

When the administration has to be extended over a long time, as, for example, in ovariotomy, it is best, as I have before suggested, to narcotise slowly, and to wait until there is either dilatation of the pupil, or some change in the position of the eye-ball.

Let it always be remembered in administering Bichloride of Methylene, as distinguished from Chloroform, that the turning up of the eye-balls is not of necessity a sign to be waited for. The Bichloride of Methylene evidently acts on the nervous centres differently, sometimes causing the eye to turn downwards, or laterally. Any one of these variations marks the third degree of narcotism, and the time when the surgeon ought to commence his operation.

When I first began the administration of Bichloride of Methylene, I was astonished at seeing double squint; but I have since come to look on it as an ordinary phenomenon, and as implying no more than the rolling upwards with which we are so familiar during the exhibition of Chloroform.

I have only one other remark to make upon the mode of administration, and that relates to the temperature of the room, a matter of the greatest importance.

As a rule, a moderately high temperature favours the action of all anæsthetics, while a low temperature—say 40° or 45°—interferes in the most serious manner, prolongs the development of anæsthesia, extends the convulsive stage, causes sickness, necessitates a larger quantity of the anæsthetic, and greatly embarasses the operator. I have no doubt that many of the so-called idiosyncracies of action, said to be manifested under Chloroform are traceable, not to the patient, but to the external condition of temperature to which he is exposed.

Bichloride of Methylene is no exception to the rule described; it always acts best at a temperature varying from 60° to 70°, and it acts well even at a temperature of 80°; but as it is very volatile, the administrator must be prepared when it is raised,

as in operations for ovariotomy, to give it more freely, and not to be alarmed if, as sometimes happens, his inhaler should become frozen, owing to the rapidity of the evaporation.

THE SPECIAL PHENOMENA OF ANÆSTHESIA UNDER THE BICHLORIDE OF METHYLENE.

The symptoms which are developed when the Bichloride of Methylene is administered have this in common with the symptoms produced by Chloroform, Ether and Amylene that there are four degrees or stages exactly as they were discovered and described by Snow.

The First stage that of preliminary excitement is shorter with the Bichloride than with any of the other of the Anæsthetics.

The Second stage, that of muscular excitement and delirious conversation, is also short if the vapour be freely given, and I have seen this stage passed over altogether. In this respect the Bichloride differs both from Ether and Chloroform, but to some extent resembles Amylene in action.

When there is a stage of excitement from the Bichloride, the mental wandering is more consecutive than under the allied substances. If the patient talks, he speaks with a kind of retained reasoning faculty, and as opposed to what is common under Chloroform, instead of being hilarious, or, it may be, vulgar and libidinous, he is disposed to serious converse and argument: as one of our friends expresses it with much emphasis, in speaking of patients under the dffierent Anæsthetics, "they groan under Ether, they swear under Chloroform, and, under Methylene, they say their prayers."

The Second stage passed—The Third stage, under the

influence of the Bichloride is one long and gentle sleep. The depth of the sleep, and the placidity has been universally noticed by those who have witnessed the administration.

Occasionally, during this stage, there is a gentle sweating, a phenomenon exceptional, I believe, in Anæsthesia. It commonly happens that when the third stage is reached, it continues from periods varying from twenty minutes to half-an-hour, without any further administration of the Anæsthetic: in children the insensibility may be prolonged over an hour, and in one recorded case great alarm was expressed from this fact. There is, however, no necessity whatever for anxiety, nor for interference. I make it a general rule, more especially in private practice, to advise that there is no fear from prolonged sleep, and that the patient should be allowed to awake spontaneously.

The Fourth stage of Anæsthesia from the Bichloride is sometimes very rapidly induced, and must always be looked for sharply; it is ushered in by abdominal breathing, blowing, and stertor. On the first appearance of these symptoms, the Anæsthetic should be withdrawn, except where great muscular relaxation is required—as in extension of joints.

Recovery when it once commences is always easy and quick.

The condition of the eye balls under the Bichloride, I have already noticed.

The pulse rises, as a general rule, sometimes going up to 130, then gradually returning to its natural character, and remaining normal; but there are some remarkable exceptions to this rule. In one case the pulse never varied at all through a deep sleep at 65°, which was the natural beat.

The breathing generally follows the pulse, becoming rapid or calm in the same relative degree; this is at once one of the peculiariites and one of the safeties of Bichloride of Methylene; there is no distinctive break in the harmonious working of the two great powers of active life.

It was admitted at once by the administrators of Methylene, that it did occasionally produce sickness and vomiting. I have been careful in observation on this point, and I find from analysis of fifty cases that it produced vomiting in nine cases, that is to say, at the rate of 18 per cent.

It is worthy of remark, however, that no more than four patients vomited *during the time of administration;* in the others, the vomiting came on after they had been returned to bed, and it might have been due to other causes. Again, in two of the four cases, where the vomiting attended the administration, the patients admitted that they had freely fortified themselves with alcohol.

In all the cases the vomiting was of very slight duration.

The cases which try an Anæsthetic most in respect to vomiting, are cases of ovariotomy. In this operation there is so much disturbance excited in the sympathetic system that vomiting seems almost to be a natural sequence. I have seen vomiting under Chloroform during this operation of so intense a kind as to be actually alarming. But in two instances in which the Bichloride of Methylene was given by myself, and in six cases by Dr. Richardson, there was no vomiting at all. This must be considered, I think, a fact of the first importance. In one of my cases, Mr. Hird was the operator. Both cases did well, and Mr. Hird's patient has since married.

COMPARISON OF THE ACTION OF BICHLORIDE OF METHYLENE WITH OTHER ANÆSTHETICS.

Under the previous head, many of the points of comparison and contrast between Bichloride of Methylene, Chloroform, and other Anæsthetics, have already been mentioned; one or two more of a special character may nevertheless be noticeed.

In the first place, although, in regard to symptoms, the

Bichloride acts very much like Ether, it is a substance far more manageable than Ether, that is to say, Anæsthesia is much more readily produced by it; it is also more persistent in action, produces no lividity, less sense of suffocation, and less of what may be called common inebriation.

Compared with Amylene, the Bichloride is far easier of administration, more persistent in effect and less exciting; to this may be added the all sufficient fact that the dangerous symptoms of Amylene, the wild excitement and sudden collapse are altogether wanting.

Side by side with Chloroform, which must be considered its chief rival, it is quicker in action, more persistent, when Anæsthesia is produced, and less exciting. It produces less frequently disturbance of equilibrium betwixt the heart and the respiration, and recovery from the after effects is easier and quicker. I have never known a single case where headache or depression has followed its administration. This alone is an important fact, for no symptoms are more severe than headache and prostration after Chloroform.

I have shown from my own experience how seldom vomiting follows the administration of the Bichloride of Methylene, and I may add that it contrasts most favourably with Chloroform in this respect. From experience in the administration of Chloroform, since it was first introduced, I consider that vomiting follows its administration in rather less than one case out of three—in round numbers in 30 per cent. of cases. This gives an average of 12 per cent. in excess of cases of vomiting after Chloroform as compared with the Bichloride: the vomiting is also much more intense and prolonged from Chloroform.

In administering Chloroform, we have often to stop, owing to vomiting, until the patient recovers sensibility, and we know that after operation, vomiting often continues for hours; these extreme results are unknown after the Bichloride. I believe that in not one of my cases did vomiting occur more than once, and then mildly.

In elucidation of this practical point, I may report a case under the care of Mr. Hancock, in which vomiting followed the administration of Chloroform three times in the same patient, and I understand in a severe form: a fourth operation being necessary, at the request of Mr. Hancock, I gave Bichloride of Methylene to this patient; I narcotized fully and deeply; the operation—removal of the lower maxilla—occupied several minutes, and the patient recovered without vomiting or even nausea. Another case of the same kind also occurred under my observation. This experience is crucial.

There are some curious physiological differences in the action of Bichloride of Methylene and Chloroform. I shall wait to give only one illustration:—There is a gentleman to whom I have administered Chloroform twelve times and Bichloride of Methylene fifteen times; the excitement has, on every occasion, been less with the Bichloride than with the Chloroform, but the striking peculiarity to which I would direct your attention is this; each time with Chloroform (immediately preceding recovery) he has spoken volubly in English and Hindostani, which latter language he was in the habit of using in India; each time with the Bichloride he has talked, at the same stage, with the same volubility, but in English, without using a word of the foreign language.

One more comparison would be required to make this history complete, I mean the condition of the structure of the human body, especially the lungs, heart, and brain after death from the Bichloride of Methylene, and after Chloroform; I am very happy to express my utter inability to supply this information. Up to this time, Bichloride of Methylene, administered by many in this country, as well as in Germany and in America, has been happily unattended by any fatal catastrophe, or with any untoward occurrence less than fatal. We must, therefore, trust to observations made on the inferior animals, which show that after death from Chloroform, the lungs and brain are left blanched and

bloodless, the right side of the heart being engorged, the left side empty; while after death from Bichloride of Methylene the lungs and brain are left containing blood, but not congested, and the right and left sides of the heart both contain blood.

Neither Chloroform nor Bichloride of Methylene darken the arterial blood.

PRACTICAL INFERENCES AND DEDUCTIONS.

It remains for me, in a few short sentences, to sum up my experience on the Bichloride of Methyelne.

I shall speak first as to the general, and next as to particular inferences.

Generally. Bichloride of Methyline acts more quickly than Chloroform, producing a longer—a deeper and more placid anæsthesia—with less preliminary excitement. This involves an important consideration of time, the time of the surgeon is saved, and I believe the risk to the patient is diminished.

In administering Bichloride of Methylene there are never observed such extreme variations of symptoms, or tendency to syncope as during the action of Chloroform: this gives confidence to the administrator, and, while it should not lessen his caution, it cannot but reduce his solicitude.

The recovery from the effects of the Bichloride is very easy: when recovery commences, it is rapidly completed—and it is infinitely less painful than from Chloroform. There is, also, less disturbance of equilibrium of action between the circulation and respiration.

Particularly. Vomiting is less frequent and less severe after Bichloride of Methylene than after Chloroform.

In short operations the Bichloride has an advantage in that, it produces sufficient anæsthesia to render the operation painless after a very brief administration : to the Dentist this is of special value, as it enables him to manipulate before the muscles close the mouth, in rigid contraction.

When anæsthesia is fully established by the Bichloride of Methylene, very little of the anæsthetic is required to sustain the action.

In conclusion, reviewing my past experience, and all I have seen of the effects of Ether, Amylene, Chloroform, and Bichloride of Methylene, I give an unqualified preference to the Bichloride, convinced that a more extended knowledge of it by the profession will confirm my views.

Up to this time, we have every reason to infer that with due caution in its administration, it is the safest of all anæsthetics: and if it should fail us, in our extreme anticipations, if it should not give us that which we all so much hope for, a perfect Anæsthetic, perfect in respect to safety of life as to abolition of pain ! it is still the nearest approach we have had towards that grand ultimatum, and affords us the expectation that with a further advance, in the same line of research which gave us this agent, the ultimatum is attainable.

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