LECTURE ON ETHIDENE-DICHLORIDE.

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GENTLEMEN,—Since the beginning of last year, when attention was drawn to this substance by the investigations of the Glasgow Anæsthetics Committee of the British Medical Association, published in the *BRITISH MEDICAL JOURNAL*, I have made use of it in hospital and private practice in almost every case requiring longer anæsthesia than that of nitrous oxide gas. I have for some time been intending to publish my experience with it, and will delay no longer, as the advantages of using it are very evident; and it is right that its objectionable properties should not be concealed or too lightly treated, especially now that the warmer weather will increase the potency of all anæsthetics of this kind.

Ethidene-dichloride ($\text{CH}_3, \text{CHCl}_2$), as it is now found in the market, has not a uniform boiling-point. It can be divided by fractional distillation into two or more substances. That which I have lately been using has a specific gravity of 1.225, boils at 115° , the temperature rising to 140° , at which it boils steadily and is nearly all dissipated. I am told that there are greater difficulties in the way of procuring the dichloride now than last year, in consequence of the waste-products in the manufacture of chloral, from which it was made, having been used up. At all events, the price has more than doubled within a year, and some of the samples I have examined have had a disagreeable after-odour. Hitherto it has nearly all been imported from Germany; but some of our English chemists are trying to make a purer drug, and I hope they will succeed.

Ethidene-dichloride mixes freely with alcohol, but only slightly with water—enough to flavour it only, but less than chloroform, which it resembles in taste and smell. It is less inflammable than alcohol. A piece of paper saturated with it does not readily take fire; but air passed through the liquid takes up a vapour which makes it burn at a jet like coal-gas.

The total number of cases in which I have administered it is *one thousand eight hundred and seventy-seven*. Of these, two hundred and eighty-seven have been major operations in surgery, including—

Amputation of breast	17 cases.
Excision of tongue	7 "
Excision of rectum	4 "
Lithotomy	7 "
Lithotripsy	8 "
Stricture	8 "
Excision of eye	15 "
Cataract	14 "
Iridectomy	23 "
Squint	27 "
Excision of tumours	7 "
Excision of jaw	5 "
Fissure of palate	44 "
Hæmorrhoids	16 "
Fistula	4 "
Colotomy	

The remaining 1,565 cases were of minor surgery, and the extraction of several or of difficult teeth; and these latter cases have put to the test the qualities of the drug, inasmuch as one administers at a disadvantage.

The table shows an experience sufficiently large to form a judgment of its use. Although, so far, my experience has been without a fatal case, I have sometimes noticed a depression of the pulse which has alarmed me; and I will to-day relate a case in which, during a struggle at the commencement of inhaling ethidene without nitrous oxide, the patient's heart suddenly failed, and he died. Although the disease of the heart was found sufficient to account for death, it was connected with ethidene, and its reputation for safety will suffer.

My usual plan of giving it is by first getting the patient nearly unconscious by means of nitrous oxide gas, and then gradually adding the vapour of ethidene. The general features of an administration are that the patient falls asleep, without moving a limb; a little convulsive twitching is seen, and then stertorous breathing; the pupils at first dilate, about the same time that stertor commences; a very little air is now given at every third or fourth respiration, and the pupil contracts. The quantity of ethidene is regulated according to the condition of the pupil or the unsteadiness of the patient, the pulse usually remaining much less affected than when the same narcosis is produced by chloroform. The anæsthesia usually continues some time after consciousness returns, and the patient awakes

almost as from natural sleep, speaking clearly. The dreams are usually pleasant, often of rapid travelling or of music, and, if one whistle or sing, it often guides the dream in this direction. The patient, within two minutes of being in the most profound sleep, if it have lasted only a short time, will get up and walk steadily. The non-interference with muscular co-ordination is equally striking in the act of talking. Vomiting has occurred in about one-third of the cases of major surgery, and in about one-twentieth of the minor cases. It is more likely to occur if the vapour have been strong enough to excite swallowing. Without exception, the vomiting has ceased sooner than it usually does after chloroform. You had an opportunity last week of seeing what it can be made to effect in a difficult operation on the mouth. A little delicate child, aged nine, was kept asleep an hour and a half, perfectly quiet, without vomiting, and even without coughing, except when the blood tickled the throat. The other severe operations on the jaw and tongue have been also very satisfactory. A private patient of Mr. Heath, and another of Mr. Hill, each had the tongue removed; the quietude during the operation and the rapidity of recovery being remarkably good. I think the most triumphant anæsthetic case I ever had was that of a patient of Mr. Durham, who removed a large malignant tumour of the palate, together with a group of indurated lymphatic glands, from the neck. Anæsthesia was perfectly sustained for an hour and a half; the patient awoke in capital spirits, and made a rapid recovery from the effects of the operation. Unfortunately, it sometimes depresses the heart's action. I have been seriously alarmed by this, and have been obliged on three occasions to lower the patient's head and induce artificial respiration. By this means, recovery has been so easily effected that I hoped that, by being on the watch for failure of circulation, it would be possible to keep the patient always safe. However, some persons have a tendency to faint from various causes; some from particular smells, others from fear. I once saw a patient fall down on the floor of my room, and thought him dead; on recovering, he told me it was the sight of a pair of common dissecting-forceps I held in my hand which frightened him, and that he had had a similar attack when looking over a hospital on the continent. And then there is true fatty degeneration, which cannot always be diagnosed.

CASE I.—A lady, about 60, had lost blood from a vascular growth of the urethra. Within the first two minutes of inhaling, I felt the pulse become small, and removed the inhaler at once. She continued breathing regularly fifteen or twenty times, then the breathing intermitted; the pulse was now imperceptible. I used artificial respiration. She recovered in two minutes; the pulse remained feeble; but I kept her insensible by occasionally giving the dichloride during the operation.

CASE II.—A gentleman, aged 30, was about being operated on for fistula. I gave nitrous oxide till he was stertorous, adding ethidene carefully. The pulse becoming small, I allowed fresh air for three inspirations. He then became delirious, and struggled, passing quickly into a state of opisthotonos. I allowed air till he had so far recovered as to speak, and then renewed the ethidene. As he became stertorous, I noticed the pulse become intermittent and stop. I removed the inhaler; the breathing continued to be free and regular. In about twenty seconds, the pulse returned; the patient awoke in five minutes in glorious spirits, though covered with perspiration. No vomiting followed.

CASE III.—An old gentleman had lost blood for a long time from piles. At first, I had difficulty in making him breathe regularly. At last, he commenced panting very quickly. As he began to snore, I noticed the pulse begin to fail, and it stopped. I drew his head to the edge of the bed, allowed it to fall back, and drew forward the tongue with my long finger passed into the pharynx. Artificial respiration was carried on for two minutes, when he recovered. He was put again in position, and I continued to keep him insensible by ethidene during the operation. In five minutes after it was over, he expressed his satisfaction in the liveliest manner.

In the first and third cases, I believe that the percentage of ethidene vapour was higher than usual, and that the rapidity of their recovery showed its superiority to chloroform. But it must never be forgotten that it cannot be used with the same freedom as ether may be.

I have now to mention a case of cardiac syncope, which terminated fatally.

A man was about to have an operation performed for hæmorrhoids. He was palish from the loss of blood which had been going on for six months. He was in the wine and spirit trade, and had lately had a carbuncle; otherwise, there was nothing particular in his history. The heart-sounds were normal. He had not eaten or drunk anything since the previous night. Laughing-gas had not acted satisfactorily, when he took it to have a tooth extracted. He struggled a good deal, and felt the pain, he said.

Being placed on his right side with his knees drawn up, dichloride of

ethidene was administered with the gas- and ether-inhaler. He did not respire regularly at first; but he never coughed, and was not observed to swallow. After twelve or fourteen respirations, he talked, and commenced to struggle. The face-piece was then removed for a little distance from the face, to allow him to breathe some fresh air. The struggling and convulsive movement which followed interfered with the precise observation of the state of the pulse; when these had ceased, there was hardly any pulse, and it soon disappeared; but he continued to breathe ten or twelve times in a satisfactory manner, and then a pause was noticed between the respirations. His head was immediately extended backward and downward over the edge of the bed, and the tongue drawn forward, whilst the feet were raised, and artificial respiration commenced. This, in about a minute, restored him so far as to cause him to try to speak in an indistinct manner, as a patient often does just before waking up. The pulse became distinct, all danger seemed past, and he was again placed in the position for operating. In doing this, he seemed to raise his head voluntarily, and some more of the anæsthetic was about to be given, when the pulse was again noticed to be failing. Without loss of time, the artificial respiration was recommenced as before, and, during the first three minutes, there were several natural gasping inspirations, but the pulse was never felt again. The case becoming desperate, an opening was made through the crico-thyroid membrane into the larynx, and a silver tube introduced. Air was blown through the laryngeal tube, during artificial inspirations, for three-quarters of an hour, after which it became evident that further attempts were useless.

The *post mortem* examination, made by Mr. Samuel Lloyd of Bloomsbury, revealed a large flabby heart, with the usual amount of fat on it; the substance seen on section, of pale tint mottled with yellow, having the ordinary appearance of fatty degeneration. The lungs were a little emphysematous, and congested posteriorly, but fairly crepitant. The spleen was friable; other organs healthy; the liver rather large.

The heart was carefully examined by Dr. Crosby, who wrote the following notes of it. "The apex of the heart, including the extremities of both ventricles, was covered with a layer of fat five-eighths of an inch in thickness, which mingled with the muscular wall so as to render it difficult to define where one ceased and the other began. The microscope showed the muscular tissue at this part to have undergone extensive degeneration, whole fibres consisting of strings of fat-globules, displacing the true sarcolemmal elements. At other portions, where to the unaided eye the muscle appeared fairly healthy, abundant deposits of oil-globules existed."

REMARKS.—With reference to this sad case, the first question is, What was the cause of death? It was clearly one of cardiac syncope, the breathing continuing for some time after the circulation had stopped. It could be accounted for, first, by supposing the administration of an excessively strong dose of the anæsthetic; secondly, by exhaustion of a weak heart in consequence of violent effort; or, thirdly, by the inefficiency of the heart's action, produced by advanced fatty degeneration. Such a heart as we found was ready to cease beating from comparatively slight causes. He had inhaled but a small quantity of the anæsthetic, and for a short time. Holding the head in a depending position, with the feet raised, and ten or twelve artificial respirations, were followed by a gasping inspiration, his pulse became regular, and he commenced speaking. Had the syncope been produced by a large dose of dichloride, the pulse would not have so soon recovered on lowering the head. If recovery of the heart's action had been brought about by the artificial respiration dissipating the vapour from the chest, and so supplying the heart with purer blood, the heart, once fairly started again, would probably have continued to act. Nevertheless, as death was probably the result of several factors, may not the depressing effect of ethidene have made the syncope fatal, which, under gas or chloroform or ether, might have been recovered from? What we know of the stimulating effect of ether would lead us to conclude that it would have been safer, but the struggling produced by ether would have been dangerous in this particular case. Had chloroform been used, and the same struggling occurred, the chances of resuscitation would have been less. The case shows how very important it is to watch the pulse as well as the breathing. The respiration was effectually performed some time after the pulse ceased to be perceptible. If the inhaler had been applied until the breathing showed signs of danger, the restoration of the circulation, which unfortunately was for a brief time only, would not have occurred at all. In any case where the pulse is observed suddenly to fail, I would not only remove the inhaler from the face, but use a towel or some kind of fan to blow the vapour away from the patient's lips, and I would also assist the natural respiration by gentle pressure on the sternum during the respirations. Seeing, also, that raising the patient to a position for operating was quickly followed by syncope, I would, in a similar case, keep the head dependent until

recovery were complete, in spite of the disadvantage of having a struggling patient to deal with.

Some of you may ask whether the failure of the heart might not arise from the stoppage of blood in the lungs, through their not being supplied with oxygenated blood. My reply is, that the circulation was restored, and the patient's lips became of almost natural colour when he was put back in position for the operation, and the inhaler was not again applied. Moreover, in giving gas, ether, or ethidene, I have always excluded air, upon the same principle, until voluntary struggling has ceased; and these cases in all exceed twenty thousand, amongst which not a single death occurred.

REMARKS ON ULCERATIVE ENDOCARDITIS, OR MULTIPLE EMBOLISM.*

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THERE are few subjects more interesting to the practitioner than embolism; but, of all its forms, that which now often goes by the name of ulcerative endocarditis—that form in which the granulations developed on inflamed valves, and may be the diseased valves themselves, tend to undergo disintegration and to be shed in small fragments into the blood-stream—is at once, perhaps, the most interesting and the most obscure.

The cases here referred to are certainly common; but there can be no doubt that they are largely misinterpreted, being apt, according to circumstances, to be mistaken for cases of ague or malarial poisoning, for cases of chronic pyæmia, for cases of enteric fever, for cases of sub-acute rheumatism, for cases of tuberculosis, and not improbably for many other affections of different kinds. The symptoms, indeed, of ulcerative endocarditis may simulate those of any of the diseases here named. There is generally, however, something special in the symptoms, something peculiar in the progress of the case, something suggestive in the circumstances under which the symptoms have arisen which stamps its nature. Especially there is generally manifest heart-disease; generally there has been antecedent rheumatism; and generally, in addition to a febrile temperature of hectic or remittent type together with the various phenomena referable to such temperature, sooner or later distinct implication of certain organs may be recognised.

I shall not stop to consider the question whether ulcerative endocarditis is dependent on the presence of micrococci in the blood and in the cardiac lesions, as many German writers contend, further than to state my own belief that, as a general rule, at any rate, there is no causal relation between them. I believe that the disintegration, or ulceration if you will, may take place spontaneously, so to speak, in any of the inflammatory or degenerative affections of the valves or other parts of the endocardial surface; and that it is especially common after or in the course of acute rheumatic endocarditis. The particles which become detached, suspended in the blood, may of course be carried into any of the terminal systemic arteries, and no doubt are carried indifferently to various parts of the body. But the consequences of their impaction will of course depend partly on the size and anastomotic relations of the arteries in which they become arrested and which they obstruct, and partly on the importance of the organs to which the obstructed arteries belong. And hence, since the brain and kidneys and spleen not only are important organs, but are supplied with arteries which beyond a certain point do not anastomose with one another, and which, therefore, if obstructed, are liable to involve the softening and disintegration of the districts to which they lead; it is easy to understand why they especially should manifest the consequences of embolic obstruction. And, as a matter of fact, in ulcerative endocarditis, the vessels of the spleen become from time to time thus occluded; so-called "infarcts", or wedges, varying, it may be, from the size of a walnut downwards, are developed in its substance, and the organ becomes enlarged. The renal vessels become similarly affected; infarcts, wedge-shaped and extending from the surface vertically inwards, form, and the kidneys enlarge. As regards the brain, no doubt analogous conditions are always liable to

* Read before the East Surrey District of the South-Eastern Branch.