SECOND REPORT ON THE ACTION OF ANÆSTHETICS TO THE SCIENTIFIC GRANTS COMMITTEE OF THE BRITISH MEDICAL ASSOCIATION,

By a Committee consisting of JOSEPH COATS, M.D., Pathologist to the Western Infirmary, Glasgow; WILLIAM RAMSAY, Ph.D., Assistant to the Professor of Chemistry; and JOHN G. MCKENDRICK, M.D., Professor of Physiology in the University of Glasgow.

SINCE the publication of the preliminary report (BRITISH MEDICAL JOURNAL, January 4th, 1879), we have administered dichloride of ethidene to six patients in the Western Infirmary of Glasgow, and the results have been so satisfactory as to induce us to report them without delay. The cases were as follows.

CASE I.—A young man aged 18, under the care of Dr. Patterson, had an abscess opened near the hip-joint. The anæsthetic was given by pouring a small quantity on a piece of lint in a tumbler, and by holding the tumbler over the patient's nose and mouth so as to allow the entrance of air along with the anæsthetic into the respiratory passages: a method regarded by Dr. Patterson as both safe and economical. The anæsthetic was given at 9.19 A.M.; at 9.27, there was complete anæsthesia; the operation began at 9.29, and was over in a few minutes; it was certainly completed at 9.32, and the patient was waking up at 9.35. During the anæsthetic state, several sphygmographic tracings were taken by Dr. Samson Gemmell, which indicate a normal amount of arterial tension. Before the operation, the pulse was rapid, probably from excitement. During the operation, it became slower and fuller; but no numerical observations were made, as our attention was concentrated on the general phenomena. The recovery was rapid, and there was no vomiting, sickness, or headache. About half an ounce of the substance was used.

CASE II.—A girl aged 13 was also under the care of Dr. Patterson, with abscesses in the thigh, from spinal disease. One abscess pointed towards the outer aspect of the thigh, while another was more in front. The opening of the first was the special operation at this time. The notes record that, before administration of the anæsthetic, the pulse was 134. At 9.47, the anæsthetic was given, and at 9.50 the pulse had fallen to 120; at 9.54, it was 100, and at 9.55 anæsthesia and muscular relaxation were complete. At 9.56½, there was vomiting (which was undoubtedly caused by the patient having had food in the morning, contrary to orders). The operation was over at 10.1, and at 10.3 the patient was recovering. At 10.5½, she was able to answer intelligently. The amount used was three drachms and a half.

CASE III.—A girl aged 8 was under the care of Dr. George Buchanan. The operation was removal of the forefinger for strumous disease of bone. At the beginning, the pulse was 120. The anæsthetic was given on a towel in the usual way of giving chloroform in Scotland; in one minute and a half, it had fallen to 110; in two and a half, to 105; in five, to 102; in six and a half, to 100; and in seven minutes anæsthesia was complete. The operation was begun when it was observed that the face had a healthy colour. At eight minutes and a half from the time the anæsthetic was given, the breathing became slightly stertorous. At the end of fourteen minutes, the operation was over, and the pulse was 105. Dr. Buchanan specially referred to the healthy appearance of the countenance. The patient recovered from the anæsthetic, so as to answer questions, in about two minutes, and there was no headache, sickness, or vomiting afterwards.

CASE IV.—The same patient as in No. 2 had another large abscess (the one in front of the thigh previously alluded to) opened by Dr. Patterson. At 9.9 A.M., before the anæsthetic was given, the pulse was 140; at 9.10½, it had fallen to 110; at 9.12, it was at 104; at 9.13, there was slight flushing of the face; at 9.14, the pulse was 100, and there was slight stertor; and at 9.15 there was complete relaxation and absence of reflex movements. The operation was quickly over; at 9.22, the pulse was 110; at 9.23, consciousness had returned; and at 9.24, the pulse had risen to 130. The amount used was four drachms.

CASE V.—A very powerful young man, aged 21, had the operation for the radical cure of inguinal hernia performed by Dr. George Buchanan. The Committee regard this case as specially interesting, on account of the length of time the patient was under the influence of the anæsthetic. Immediately before giving the anæsthetic, the pulse was very rapid from excitement—about 140. At 9.17, the anæsthetic was given; at 9.18½, the pulse had fallen to 110; at 9.22, pulse 110 and slight struggling; at 9.23, it was observed that the face was slightly

flushed; at 9.24 and at 9.26, considerable struggling; at 9.28 (eleven minutes since the anæsthetic was given), the pulse had fallen to 74, and the operation was commenced; at 9.35, pulse 70, and respirations deep and regular; at 9.40, the operation was over, and at 9.42 consciousness returned. About 9.41, there were deep anæsthesia and complete muscular relaxation: a condition specially necessary for such an operation. Dr. Buchanan expressed himself to the students present as thoroughly satisfied with the result, and he specially alluded to the tranquillity of breathing and the healthy colour of the lips and of the countenance. The amount used was an ounce and a quarter.

CASE VI.—A little girl aged 8, pale, emaciated, and excited, had several pieces of diseased bone removed from the ankle by Dr. Buchanan. Before giving the anæsthetic, the pulse was small, thready, and so rapid as to be uncountable. The anæsthetic was given at 10.3½; at 10.5½, the patient was "over", and the operation was begun. It was completed in a few minutes, and, after 10.10, no anæsthetic was given. She quickly recovered consciousness, when there was some retching. It appears that this girl had been ailing with sickness and occasional retching for several days previously. The amount used was about two drachms. Dr. Finlayson, one of the physicians, happened to be present, and he directed attention to slight rigidity of the muscles on the right and left sides alternately during the operation. It is probable that such spasms, sometimes seen during the administration of chloroform, are reflex, due to nerve-irritation by the operation; but this is a point to which the Committee will direct further attention. In this case, the pulse remained feeble throughout, and the diminution in frequency, so marked in the other cases, could not be determined.

Such is a short record of the six cases observed by the Committee. Three features are of special interest. 1. There was no injurious effect observable on the respiratory mechanism, although in all cases the anæsthetic was given in such doses as to produce complete anæsthesia and muscular relaxation, and in one (No. 5) the patient was deeply under its influence for twenty-five minutes. The question, however, of the limit to which the agent may be pushed without injuring respiration is of such immense practical importance as to induce the Committee to make a further investigation on this point. 2. The pulse diminished in frequency and increased in volume, and in the deepest anæsthesia it was steady, regular, full, and compressible. There was no indication of failure of cardiac action in any case: a result anticipated from what had been previously observed in animals. 3. There was never any pallor of the countenance or blueness of the lips, but, on the contrary, and even during the deepest anæsthesia, there was a healthy flush on the face and the lips were rosy-red. Taking into account the change in the character of the pulse and in the colour of the face, it would appear that, in anæsthesia from dichloride of ethidene, the blood still remains in a normal amount in the arterial and capillary systems, and does not tend to engorge the venous system and right side of the heart, as is apparently the physiological action of chloroform.

The total result appears to the Committee to be, that dichloride of ethidene, as an anæsthetic, presents all the advantages of the ether, without any of its disadvantages; and that the following opinion of Steffen, given in Binz's *Evidence of Therapeutics*, p. 39, is correct in most particulars: "It is said to have the following advantages over chloroform, which it resembles in its ultimate action, namely, a pleasanter smell, the power of producing narcosis more rapidly, as well as without excitement or vomiting, more rapid recovery without after-effects, and altogether less danger." In our experience, narcosis has not been produced more rapidly than with chloroform, but rapidity of narcosis depends very much on the mode of administration. If an anæsthetic be given cautiously and in small doses at first, the super-vention of narcosis will be slow; but if it be given in a large and concentrated dose at first, the time no doubt may be shortened. Again, in one case (No. 5), there was excitement, and in two cases there was retching. In both the latter, however, the circumstances were peculiar; in one, the patient had previously taken a meal; and in the other, sickness and retching had occurred for several days, and the patient was in a very weakly condition.

The Committee now intend going on with inquiries on the following points: 1. The action on the human being of isobutyl-chloride; 2. The *modus operandi* of anæsthetic substances on the respiratory centres; 3. The action of chloroform, ether, dichloride of ethidene, and chloride of isobutyl on blood-tension; and, 4. The action of these substances on protoplasm. The suggestion of Mr. Clover, in the JOURNAL of January 11th, will also receive attention.

The substances used have been obtained from C. A. F. Kalbaum of Berlin, through Messrs. Burgoyne, Burbridges, and Co., 16, Coleman Street, London. The chemical member of the Committee, Dr. William Ramsay, is making a special investigation into the modes of manufacture, the impurities, and the tests of anæsthetic agents.