EXPERIMENTS WITH CARBOLIC ACID.

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(*Concluded from page* 148.)

17*th February*, 1871.—Dog No. 8, about the size of a water spaniel. At 7-46 a.m., ʒss. of acid was given in ℥ss. of warm water. In thirty seconds he was staggering; in one and half minutes he was frothing at the mouth; in four minutes, ten grains of carbonate of ammonia in half an ounce of water was administered; and two minutes afterwards he fell over and could not rise. The eyes were now examined and found bloodshot, with the pupils dilated. In ten minutes from the time of giving him the acid, a little cold water was sprinkled on his head and back, when he got up, and in about half an hour appeared all right again.

19*th February*.—At 7-16 a.m., forty minims of the acid were given in half an ounce of tepid water, when he fell down as soon as he was let go. In thirty seconds, ʒss. of spt. ammoniæ aromat. and ʒss. of spt. æther nitr. in ℥ss. of water were given, but without any apparent effect. There was violent emprosthotonos, the body being quite curved and his tail as violently curved upwards; there was hoarse rattling in his throat, eyes bloodshot, and tongue protruding. He died in ten minutes.

Post-mortem at 5 *p.m.*—The skull and spinal canal alone were opened. Over the whole surface of the brain there was serous effusion, as also into the ventricles of the brain, and the brain substance also exhibited numerous vascular points. The membranes of the cord were also very vascular, and the spinal vessels gorged with blood; but no change was noticed in the nervous substance itself.

3*rd March*.—Dog No. 9—a puppy. ʒss. of acid was given; he at once fell down convulsed, and died within ten minutes. A post-mortem was made one hour afterwards. The heart was full of dark fluid blood. The lungs also, together with the liver, were gorged with fluid blood. The kidneys were deeply congested, and the bladder full of dark urine, which smelt strongly of the acid. The vessels of the brain were also gorged, and there was a thick layer of serous effusion over the surface of the brain.

5*th March*.—Dog No. 10, as large as a pointer. At 7-6 a.m. forty drops of acid in half an ounce of water were given. He at once began to paw his mouth, and in two minutes jumped up, broke his string, and ran, staggering, for about twenty yards, when he fell over, but was able to get up, and kept jumping in a gyrating manner for some time, with his hind legs well under him. The breathing was accompanied by a rattling noise in the throat. At 7-15 his bowels were moved; motion had scybalæ. He gradually recovered after this, and was all right in half an hour.

On the 7th and 14th March respectively, ʒi. of the acid in ʒss. of water was given, with merely a repetition of the symptoms before described; there was no increase, and he recovered fully in half an hour each time.

3*rd April*, 6-15 *a.m.*—ʒiss. of acid in tepid water was given. In thirty seconds he staggered and fell, but was able to rise. His breathing became heavy, and in another thirty seconds he again fell over and was then unable to rise. His pupils were now found widely dilated, but eyes not particularly red. The spasmodic action of the limbs was continuous and strong, and body curved into a ball. At 6-40 he began to revive, and in another hour's time appeared quite recovered.

4*th April*, 6-22 *a.m.*—ʒii. of acid were given in tepid water, when he fell down at once; the breathing became sterterous, eyes bloodshot, and pupils widely dilated, with the tongue somewhat protruding; spasms of limbs strong, and body curved. He lay in this state until 9 a.m., when he sat up and drank a little water; but again fell over and lingered until 2 p.m., when he died.

A post-mortem was made at 5 a.m. The brain was covered with serous effusion, and vessels gorged with fluid blood. The vessels of the spinal cord were also gorged, and on cutting across the cord, in several places numerous red points were seen. The thoracic and abdominal viscera were distended with dark fluid blood, and the intestines (lower) contained dark fæces.

SUMMARY.

Having commenced these experiments with the view of ascertaining the maximum safe dose of this acid, and its action on the system when given in large does internally, I think I have gone far enough to satisfactorily settle these points; but when in the course of my labors I saw results somewhat contrary to what authors have ascribed to it, I was led to give the details of the trials, so that others interested in such investigations might themselves judge of my conclusions. This, I beg, may be accepted as an excuse for having imposed on them the uninteresting accounts of each dose exhibited; and I will now endeavour to give my opinion of the physiological effects of this most powerful and valuable drug, so far as I have been able to satisfy myself as to its action.

All my experiments have been with the crystallized acid obtained from Messrs. Bathgate and Co., of Calcutta.

First, then, as to the dose. At the commencement I began with a very small dose, and gradually increased it drop by drop; and it was not until I had given fifteen minims three times a day that I noticed any particular effect: but after the third of such doses, on the same day, there was noticed some heat and irritability of the mouth and stomach, as shown by the dog putting his nose into and lapping water, but yet in a manner that showed he was not thirsty; whilst twenty minims, thrice daily, caused decided agitation, which however wore off in a short time; and any increase on this dose was attended by more and more severe symptoms, up to perfect insensibility, with stertorous breathing, blood-shot eyes, dilated pupils, and loss of muscular power; but even these symptoms wore off within the hour, if the dose was not fatal.

The smallest fatal dose was half a drachm, given to a half-grown puppy (dog No. 9) and to dog No. 5, which killed them within ten minutes; whilst forty minims killed dog No. 8 in the same time. This was the shortest period in which death occurred.

It will have been seen from my first cases that if the dose was very gradually increased, a tolerance of the drug resulted, and as much as a drachm might be given with merely evanescent symptoms. I need not say anything about the larger doses, as any quantity above fifteen to twenty minims will give rise to severe symptoms, and half a drachm will probably prove fatal.

Antidote.—There is no time to exhibit any. The action of the drug is so rapid that there is not time to take any steps. If the person who has taken a large dose be seen at once, immediate vomiting should be induced by tickling the fauces, or by the use of the stomach pump; and cold applied to the head, a little brandy given, and perhaps artificial respiration might be useful. Ammonia, either as the carbonate or as the aromatic spirits, did not appear of use. Oil given with the acid greatly neutralized its effects, but given afterwards had little or no effect; nor had milk, or white of egg.

Action.—The action of carbolic acid appears almost similar to that of prussic acid. It affects with nearly equal rapidity; but whilst, in poisoning by prussic acid, stertorous breathing seems to be the exception, with carbolic acid heavy sighing (dog No. 6) is exceptional, and stertor the common symptom; and in the fluid state of the blood, universal congestion of the organs, and serous effusion over the surface and into the central

cavities, they agree; as also in the staggering gait, foaming at the mouth, and loss of control over the muscles of locomotion. It also seems to have a paralysing effect on the involuntary muscles, seen in the dilated flaccid heart, dilated blood vessels, distended bladder, &c., and the entire check of the secretions of the intestinal canal; the contents, whenever examined, have been found hard and scybalous, or thick and ropy,—the congestion of the intestines being more severe where the acid had been given for some time, than when administered in one fatal dose. By check of secretions I mean their non-discharge into the intestines, as the gall-bladder was usually found distended with dark bile.

In the human being I have tried it in several cases of bowel complaint with advantage; my opinion is, that in dyspeptic diarrhœa, where there are frothy fermenting stools, it acts as an antiseptic as well as a sedative. In dysentery, attended with discharges of mucus, and mucus with blood, it relieves the spasms of the intestines by its sedative action; and given with mucilage and small doses of tincture of opium, I have obtained good results; but when given in 5 or 6-minim doses three times a day, the patients, after the third or fourth day, have complained of a sinking, fainting sensation at the epigastrium; and almost every patient complains of its producing a soreness in the mouth (but not the teeth-on-edge acidity of the mineral acids), and an increased flow of saliva. Hence I would not advocate a larger dose than five minims, if to be repeated three or four times during the day; and I must add that I am not satisfied that it would be equally beneficial in cases of acute dysentery.

One of my hospital assistants, at my suggestion, tried it in cholera, and states that it checked the vomiting; but I have no personal experience on this point.

Externally, I have tried it extensively on foul ulcerating sores, and with benefit; but in one case, when using one part of acid to ten of water, to a large sloughing surface, symptoms of agitation, with fluttering of the pulse, difficulty of breathing, and failure of the heart's action ensued, but were combated by lowering the patient's head, giving brandy, and inhaling carbonate of ammonia, with cold effusion to the head. This proves that even its topical use requires care; and although the whole body might be smeared with an ointment of the acid in a case of confluent small-pox (as recommended by Dr. Aitchison), yet in a mild case, where the absorbent power of a large portion of the skin remains unimpaired, such a proceeding would be attended with risk. My experience of its use in leprosy is limited, but so far not encouraging.

Such briefly are the results of my experiments, and in making them known, I do so, not as proved conclusively, but rather to encourage further research, which may either confirm or modify them.

ON THE ETIOLOGY AND HYGIENE OF CHOLERA.

By T. Oughton, *Staff Assistant Surgeon, Neemuch.*

Dr. W. B. Carpenter is probably the latest contributor to the numerous hypotheses, respecting the causation and intimate nature of this fearful scourge, which have been propagated by the acutest thinkers of our profession at various times. His theory is that a cholera-molecule—or "cacozyme," as it is termed by him—is introduced into the system in various ways, and that a peculiar fermentation is set up whenever this vitiated molecule comes into contact with certain waste tissue that is ever finding its way into the blood; the full expression of such fermentation being exhibited in cases wherein there exists an excess of such organic debris in the circulating fluid, and being coincident with the phenomena of a choleraic seizure. Moreover, he coincides with the opinion of most sanitary authorities, that the alimentary mucous membrane is the principal medium through which the factor of cholera enters the system. The reader is referred for the details of this very able hypothesis regarding this disease to the *Lancet*, 2nd December, 1871.

It may be premised that my views in reference to the above malady coincide with those of Dr. Carpenter in regarding it as essentially a blood disease. The blood becomes loaded with the morbid virus more or less, and the air surrounding the sick man is charged with it at every act of respiration, and it arises also as an exhalation from the rice-water stools, the morbid secretions of the skin, &c. In pursuing the present hypothesis further, I propose to introduce a series of interrogations in the order in which they have occurred to me, and to embody my views on the subjects of the etiology and hygienic treatment of cholera in my replies thereto. I must be permitted to explain, however, that these replies have been based partly on a review of a series of medical histories of the disease which have appeared in the *Medical Report of the Army* from time to time, and partly from a personal experience during two epidemics occurring at different periods in Africa and the West Indies.

It will, perhaps, be as well to state the case of these epidemics before proceeding further; and they are especially interesting, inasmuch as the disease had never been known on the West Coast of Africa at any previous period, and I believe the same remark is applicable to the West Indian epidemic. An invasion of cholera occurred at Kingston, in the island of Jamaica, during the year 1852, and its origin and progress may be recorded as follows. A sailor was brought on shore from a ship lying in the harbour, which had recently arrived from Halifax, where the epidemic had been raging at the time of the ship's departure. The nature of his malady was unknown at the time of his admission into the Kingston hospital, but it speedily revealed itself as a case of genuine Asiatic cholera; and the hospital authorities were exceedingly anxious that the cause of the man's death should be kept a secret. A few days subsequently, however, notwithstanding that the strictest secrecy had been adhered to on the subject, two or three choleraic seizures occurred in the lunatic asylum adjoining the hospital premises, and after a longer interval three or four cases were reported in the city of Kingston, these being the forerunners of an epidemic of considerable magnitude.

The epidemic in Africa prevailed at Bathurst—a military station on the river Gambia—during the middle of the year 1867. This epidemic was distinctly traceable from Senegal, whence it was supposed to have been imported by some pilgrims travelling in caravans, to MacCarthy's Island in the first place, and from MacCarthy's Island to Bathurst. An exceedingly interesting feature in the extension of the disease between the two latter places consists in the fact that MacCarthy's Island is 250 miles eastward of Bathurst, and that the prevailing wind during that period of the year blew from the west. The above-mentioned facts may tend to exemplify the replies to some of the following queries which I proposed to myself for solution.

The etiology of cholera.—How does the specific poison of cholera gain admission into the system? As a rule, by the breathing of a vitiated atmosphere.

How does the atmosphere become vitiated in the first instance? By exhalations from cholerous excreta long buried in the earth, these being disengaged by either mechanical exposure or the operation of an unusually high temperature; by exhalations from cholerous clothes long confined in boxes; by exhalations from cholerous grave-yards in excessively hot weathers, possibly accelerated by a previous rain-fall whereby the poison is dissolved and rendered portable. It may be noted with reference to the last-mentioned mode of causation—1*st*, that the general grave-yard of Bathurst was situated to windward of the town; 2*nd*, in a report upon the "Station and Vicinity of Neemuch" with reference to an outbreak of cholera which