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SOME NOTES ON THE POISON CON-
TAINED IN CHOLERAIC ALVINE
DISCHARGES.

BY VINCENT RICHARDS, F. R. C. S. E.

It has been customary—though not universally so—to regard the choleraic alvine discharges as possessing some peculiar poisonous properties. But so far as I am aware, the fact has never been satisfactorily and conclusively established by actual experiments. Still less has any hint been given as to the true nature of the poisonous agent, further than it was supposed to be a “germ” of some description. Dr. Koch, the eminent German savant, has discovered in choleraic discharges and within the bodies of the affected, a peculiar bacillus which he believes to be the cholera-producing agent. He has not, however, succeeded in producing any appreciable results by the inoculation of isolated and cultivated bacilli. I have no knowledge of the details of Dr. Koch’s investigations, but it is only natural to assume that had he met with any marked success in that direction, we should have heard of it. In the March number of the *Indian Medical Gazette* I published a short account of some experiments made with choleraic dejections in the case of dogs, and it will be remembered that I failed to obtain positive results. By a lucky thought it struck me to try the experiment on pigs, which are in this country, at least,

peculiarly foul-feeding animals. I gave to a small pig, three months old, a choleraic discharge which had just been evacuated by a patient in the hospital. The evacuation was of the pinkish colour so common in the alvine discharges met with in the most fatal form of the disease. This was in the morning when I visited the hospital. In the evening it was reported that the animal had vomited once after being very restless, and that it had soon afterwards died. At the post-mortem examination I found the stomach contained a glairy yellowish fluid, part of the smaller intestines empty, and the rectum full of semi-fluid greyish fæces. The lungs were much congested, the right side of the heart was full of fluid blood, and the left empty. The blood was fluid. It was fortunate that in this instance the alvine discharge contained the poison, or in view of my past experience I might have been inclined to abandon the enquiry. It is well known that country-pigs consume human excrement, which must be to them, under ordinary circumstances, perfectly innocuous. But the following experiments shew that they can consume even suspected discharges with apparent impunity.

I.

Removed the semi-solid contents of the intestines of a pig which had been killed by the alvine discharges of a cholera patient, and after liquefying them with water, administered the whole to a half-grown pig. Never affected. The next day gave it the alvine discharges from a patient who was apparently suffering from the first stage of cholera. The discharge

though rice-water like was slightly coloured with bile. The patient, I may observe, recovered. The animal was never affected, but it was on a subsequent occasion some days afterwards, killed in one hour and twenty-eight minutes by the administration of an undoubted choleraic evacuation.

II.

Removed the contents of the intestines of a patient who died overnight from cholera, and gave half, about 2 oz., to a half-grown pig. The fluid had a most offensive odour, and was partly decomposed. Kept several days under observation, but was never affected. The same experiment was repeated on the animal, but it remained unaffected.

III.

Administered the other half of the fluid referred to in expt. II to a half-grown pig. Kept many days under observation, but was never affected. Repeated the experiment with a suspected evacuation, and although it appeared to be unwell, it was never seriously affected. This animal had a spear wound in the side, and it became rather weak. On a subsequent occasion it died *in fifteen minutes* after having him given the contents of the intestines of a patient who had died two hours previously from cholera.

In strong contrast to these experiments are the following, which prove the extreme malignity of the poison contained in choleraic alvine discharges at certain stages of the disease. I

may here observe that the pinkish colored evacuations appeared to be the most poisonous.

IV.

On the 18th March at 10-30 A.M. I removed the fluid contents of the intestines of a patient who had died from cholera and administered them to a nearly full-grown pig. The fluid resembled an ordinary cholera evacuation of a pinkish colour.

At 11-20 the animal passed a large quantity of semi-fluid clay-coloured fæces. It became very restless and gasping for breath.

1 P.M.—Passed another stool of a similar character. Still more restless, and the respiration is much embarrassed; soon after this it became convulsed.

1-10 P. M.—It again passed similar fæces.

1-20 P. M.—Dead—in 2 hours and 50 minutes

V.

9 A. M. Gave a choleraic evacuation to a half-grown pig. At 9-15 A. M. it became extremely restless, and the respiration greatly embarrassed. The nose and ears, which had been of a light pink colour, became bluish. The animal's restlessness increased and at intervals there was an ineffectual attempt to take a long inspiration.

9-58 A. M.—Strongly convulsed.

10 A. M.—Respiration ceased, but it was not until 10-28 A. M. that the heart's action quite ceased. The chest was opened some time after the cessation of respiration. The animal had

passed a small quantity of urine which was found to contain albumen and a trace of uro-xanthine. I should have tested for the chlorides as suggested by Crombie, but had no nitrate of silver at hand. It is not important however, as in such an acute case and in the absence of any purging, it is scarcely likely that there would have been any marked deficiency of the chlorides.

The principal post-mortem appearances were the following:—The lungs were normal; the heart nearly empty. The rectum contained a small quantity of solid fæces. The small intestine contained a small quantity of bloody fluid, and the large intestines were empty. The stomach contained a small quantity of greenish coloured fluid. Liver gorged with blood; gall-bladder full. Kidneys also gorged with blood. Blood fluid throughout.

In the face of these results it can no longer be questioned that the alvine discharges at certain stages of cholera do contain a powerful poison whose chief action is to enfeeble and destroy the function of respiration. And in this respect it seems *somewhat* to resemble the action of the proteid—venom globulin—which has been discovered in the venom of snakes by Drs. Weir Mitchell and Reichert. Now, what is the nature of the poison? Is it an organism, or is it a chemical compound? In my opinion the rapidity with which it acts altogether excludes it from the possibility of its being an organism. While on the other hand the rapidity of its action and its comparative instability as plainly indicate that it is in the nature of a chemical

compound—possibly, but this is mere conjecture an albuminoid body. Its instability is, I think very clearly shown by experiments II. and III. The poison which had, no doubt, existed in the fluid of the intestines had been destroyed by decomposition ; at least that appears to be the most probable explanation of the in ocuousness of the material used in those two experiments. Had the poisonous character of the alvine discharges depended upon the contained bacilli, the results of the experiments would have been very different, since the decomposition of the vehicle would scarcely have affected the vitality of the bacilli. I would not be understood to mean that I think it impossible the poisonous element is given off during the decomposition of the evacuations. I do most emphatically believe that the evacuations lose their toxic qualities by decomposition ; but whether the poison is given off or is destroyed, it is at present impossible decidedly to say, though the probabilities are much in favour of the latter supposition. It may, of course, be questioned whether the poison now proved to exist in choleraic alvine discharges is the identical poison which produces the disease. But I would point out that the principal physiological effect is precisely the same. Any one experienced in the observation of cholera cases knows that the really prominent symptoms are the restlessness and distress consequent upon embarrassed respiration. In this connection Dr. Aitken remarks, “ The *post-mortem* appearances, and the order of the symptoms, tend to show that the blood is obstructed in its passage through

the lungs ; and that the loss of animal heat, embarrassment of the respiration, and gradual arrest of circulation are produced by some aberration of the proper respiratory changes or impediment to them." The purging, which is not a prominent symptom in the pigs experimented on, may be *mainly* due to paralysis of the mesenteric nerves the result of the circulation of a vitiated or imperfectly oxygenated blood, or it may be a mere effort of elimination. The poisoning of the pigs was so rapid that there was not sufficient time for the complete evacuation of the intestinal canal ; though it will be noted that a bloody fluid was found in the intestines of one of the animals. There are, of course, other explanations, either there may be some slight difference in the mode of action of the poison in the case of pigs and that of man, or exterior to the system it may acquire a further special property. But be this as it may, the main physiological character of the two poisons is precisely the same. What is now required is a most thorough and searching enquiry into the chemistry of the alvine discharges in cholera so that the poison may be, if possible, isolated and its chemical and physiological characters definitely determined. As regards disinfection, I am persuaded that from the nature of the poison the best means of disinfecting choleraic evacuations is the admixture of a solution of the permanganate of potash? but I have not yet had an opportunity of deciding the question. I would thus summarise the results which I think fairly deducible from my investigation.

1stly.—That choleraic evacuations, at certain stages of the disease, contain a most virulent poison.

2ndly.—That if the poison finds its way into the stomach, it is absorbed and rapidly proves fatal.

3rdly.—That the principal action of the poison is to enfeeble and destroy the function of respiration.

4thly.—That the poison is not an organism, but of the nature of a chemical compound of a comparatively unstable nature.

5thly.—That it will probably be found to be easy to destroy the power of the poison existing in the evacuations, in other words to disinfect them.

6thly.—That although the poison decomposes, it might by desiccation retain its powers for some considerable time. Hence clothes, &c., stained with choleraic discharges might be a source of danger.