A CASE

OF

POISONING BY CHLORAL HYDRATE;

INTRODUCING A NEW TEST.

BY

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A CASE OF POISONING BY CHLORAL HYDRATE: INTRODUCING A NEW TEST.

The appearance of an article in the October (1877) number of Eulenberg's *Vierteljahrsschrift für Gerichtliche Medicin*, by Professor Falek, of Marburg, entitled "Toxicologische Studien über das Chloral Hydrat," recalled to my memory a half-written paper on the same subject which I had begun in the spring of that year; and as the appearances noticed by me at the post-mortem examination of a man who had taken a fatal dose of that poison agree in the main with those found by him in rabbits, cats, and dogs, it may be useful to publish the case, especially as it will serve me for an introduction to a new test for this drug which I found out some years ago, and proved in this case.

I commence, then, with the history, so far as known, of the poisoning; giving the post-mortem appearances; relating the tests I employed to prove the presence of chloral in the body; and concluding with a notice at length of the proposed test.

I.—History of the Poisoning.

A farmer, in the neighbourhood of Aberdeen, had been in the practice of taking chloral hydrate, partly under medical advice, but to a greater extent unknown to his medical adviser, and had always a quantity of it by him, generally carrying a bottle in his pocket. One evening he went out to look after his cattle, but as he did not return that night, a search was made for him, and after some time he was found lying dead at the foot of a wall. The circumstances of his death, and some slight bruises about his hands and legs, led to an investigation by the law authorities, and I was asked to go and examine the body along with the doctor of the neighbouring village (Dr Reid, of Ellon).

II.—Post-mortem Examination.

The appearances found at the inspection, made on the 1st of August 1876, about thirty-six hours after death, were as follows:—

Externally.—The joints rigid; the pupils of the eyes normal in size; the face, front of neck, top of chest, and back parts purple. Several excoriations, with effusion of clotted blood, on the backs of both hands, and on the left leg and foot. Well-marked goose-skin on the outer sides of the thighs. The penis retracted.

Internally.—The scalp congested; the cerebral sinuses filled with clotted blood; the bloodvessels on the surface of the brain full of blood; the arachnoid thickened and of a gelatinous appearance; a large quantity of clear watery fluid under the arachnoid and in the ventricles of the brain; the brain apparently somewhat wasted, but otherwise natural, no great amount of bloody spots being noted. Nothing unusual in the mouth, pharynx, and œsophagus, except that the last was thrown into folds, and its mucous membrane somewhat softened; but the parts at the top of the windpipe were œdematous, and the mucous membrane of the windpipe was injected and dark red in colour. The lungs were deeply congested and œdematous. The heart was healthy, but its right cavities contained ten fluid ounces of blood, and its left three fluid ounces, the blood in both cavities being dark, partly fluid and partly in dark firm clots. The gall-bladder was distended with bile. The liver, spleen, and kidneys were much congested, the liver and kidneys being slightly fatty, and the spleen being softened. The urinary bladder was full of urine of a pale colour. Stomach containing a brownish fluid, having a peculiar odour, and solid particles (starchy). The mucous membrane of the great cul de sac of the stomach of an uniform brown-black colour, with several patches the size of a sixpence of bright red punctiform extravasation. The blackening extended in streaks towards the smaller end of the stomach, following the course of the bloodvessels, and the rugæ of the stomach were greatly swollen and œdematous, and of a red colour, which near the larger end of the organ was dark-brown red, and became brighter towards the small end, where it was scarlet-red. Several patches of punctiform ecchymosis were also observed in the middle portion of the stomach. The intestines showed no marked abnormal appearances. The blood throughout the body was of a dark cherry-red colour, giving the muscles a brighter hue than usual.

From these appearances my colleague and I gave it as our opinion that death had been probably caused by one of the narcotico-acrid class of poisons, but stated that a chemical examination was necessary to determine the point with certainty, and that with this in view we had preserved some of the viscera, blood, and urine.

An order to make the necessary analysis was sent me subsequently, and I proceeded to act on it along with my father, Professor Ogston, with the results which shall be described hereafter.

In the meantime I shall recapitulate the points which seem to me characteristic of poisoning by chloral hydrate:—(1.) The bloodvessels of the membranes of the brain were full of blood. (2.) The sinuses contained clotted blood. (3.) The arachnoid was œdematous; and (4.) under it and in the ventricles of the brain

clear serum was found in considerable quantity. (5.) The brain substance appeared somewhat shrunken, but no unusual number of bloody points was noted. (6.) The œsophagus was slightly contracted and rugose, and its mucous membrane was softened. (7.) The parts at the top of the larynx were œdematous, and the mucous membrane of the trachea showed fine injection of its bloodvessels. (8.) The lungs were œdematous, and deeply congested. (9.) The right cavities of the heart were filled with blood (10 fluid ounces), and the left were comparatively empty (3 fluid ounces). (10.) The blood in the heart was partly in firm black clots and partly fluid. Here and throughout the body it became on exposure of a dark cherry-red colour, somewhat darker than that found after death by cold. (11.) The urinary bladder was filled with urine of a pale colour; its walls normal in colour. (12.) The gall-bladder was distended with bile. (13.) The liver was loaded with dark blood. (14.) The kidneys were loaded with dark blood. (15.) The spleen was somewhat soft, and loaded with dark blood. (16.) The stomach showed remarkably the action of the poison, as has been already fully described. (17.) The great and small intestines showed nothing unusual.

These appearances agree pretty closely with those noted by Professor Falck in some of his cases; the only ones which differ from his—and that only in degree—was the appearance of the stomach, which presented traces of strong irritation, almost approaching to corrosion, and the normal condition of the intestines.

In summing up the pathological appearances, I cannot quite agree with Professor Falck, that these appearances are not characteristic, which is what he seems to imply (V.J.S., p. 430); for from the study of his cases, combined with my case, it seems to me that we have clear signs of death by asphyxia; and in addition more or less marked signs, in my case very well marked, of irritation along the digestive tract—signs which place chloral hydrate in the class of poisons known as narcotico-acrids.

III.—Chemical Analysis.

So far I have assumed that the man I refer to had died from poisoning by chloral hydrate, it now remains for me to show what steps I took to prove this, by demonstrating the presence of the poison in the body.

I took two portions of the contents of the stomach.

1. One of these I filtered, and thus obtained a straw-coloured fluid, which I concentrated and divided into two parts, *a* and *b*.

To *a* was added caustic potash, but no reaction followed.

To *b* was then added a few drops of *old* ammonium sulphide, when the straw-coloured liquor was first turned greenish (the colour of the $(NH_4)_2S$, and after a little time it became again straw-coloured, changing slowly to a dark yellowish brown, and letting fall a very slight brownish amorphous precipitate.

2. I then dialysed the second portion of the contents of the

stomach, passed the fluid dialysed through a filter of animal charcoal, obtaining a colourless fluid, which I concentrated from 2 oz. to less than ʒi., and divided into three parts, *a*, *b*, and *c*.

To *a* I added caustic potash, but got no reaction.

b Was still further concentrated to 2m, when, on adding caustic potash and heating slightly, a very faint odour of chloroform was perceptible to both my father and myself, but no trace of precipitate appeared.

To *c* was added $(NH_4)_2S$, when the same result followed as with portion 1 *b*, only that the colouring was better marked from the reaction taking place in a previously colourless liquid.

I then tried the tests on portions of the blood dialysed and filtered through charcoal, but got no reliable result with either; though the $(NH_4)_2S$ gave some indications of the presence of chloral to me, which, however, my father would not allow to be convincing.

With portions of urine I got no result with either test.

I thus established the fact that the man had taken chloral hydrate, and probably, from my finding it in the stomach, not a very small amount of it; and this, coupled with the appearances in the body, led me to the conclusion that the case was a true case of chloral poisoning.

IV.

I shall now, in conclusion, say a few words on the test for chloral by sulphide of ammonium, which I wish to lay before my medico-legal brethren.

The addition of stale sulphide of ammonium to a solution of chloral hydrate of moderate strength, say 10 gr. to the drachm (the strength of the British syrupus chloralis hydratis), causes, in a short time (*not immediately*), the colourless liquid to assume a slight orange-yellow colour, the liquid remaining clear; on letting it stand, the colour gradually deepens to a brown, and now a cloudiness comes over it, which in about half an hour, or perhaps longer, is deposited as an amorphous precipitate of a brown colour, and which appears to consist of sulphur.

While the change of colour is going on and the brownness appears in place of the orange, a gas is given off of a most offensive smell, apparently a mixture of chloroform and hydrogen sulphide, with something in addition, in such quantity as to fill a large room in a few minutes.

In order to find out the smallest quantity of chloral hydrate which would give a reaction with ammonium sulphide,

(*a*) I dissolved 1 gramme of it in 100 cc. of water, took 1 cc. of the solution and added 1 cc. of ammonium sulphide, when the solution became of a canary yellow colour, passing through orange-yellow to brown in the course of about six hours, letting fall a slight brown precipitate and giving off a characteristic smell.

(*b*) I then took 10 cc. of the above 1 p.c. solution, which I put into 100 cc. of water, and, on adding 1 cc. of ammonium sulphide

to 1 cc. of this solution, I got in about half an hour a slight straw colour which had deepened to a pale orange colour in twelve hours, giving off no smell.

(*c*) Lastly, I took 1 cc. of the solution *a*, which I added to 100 cc. of water. Of this solution I took 1 cc., and added 1 cc. of ammonium sulphide, and, after standing for eighteen hours, the liquid had changed to an exceedingly faint straw colour.

Thus 1 cc. of *a* solution (0·01 gramme of chloral hydrate) gave the brown colour, the precipitate, and the smell.

1 cc. of the *b* solution (0·001 gramme) gave an orange colour, but neither precipitate nor smell.

1 cc. of the *c* solution (0·0001 gramme) gave a very faint straw colour.

The first and second of these results are, I think, sufficient to establish the presence of chloral hydrate; the third I should hardly trust to, as the reaction was so faint, though I verified it by repetition of the experiment.

I may further state, that the similarity of the reaction of ammonium sulphide with chloral hydrate to that with antimony salts, suggests a caution in accepting the orange coloration alone as a certain test for either poison. Antimony, on the one hand, may be known by the orange precipitate thrown down by the addition of an acid, which does not follow when it is chloral hydrate which is present; and chloral hydrate, on the other, by the fact that the orange colour deepens on standing to a dull brown.

In conclusion, chloral hydrate alone seems to give this reaction with ammonium sulphide, for I have submitted many of the substances of similar chemical construction to the test without any such result following. Among those were chloroform, chloric ether, formic acid, etc.

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