

THE OUTBREAK OF ARSENICAL BEER-POISONING AT HALIFAX.*

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I HAVE no doubt it was generally thought, with the disappearance of Messrs. Bostock's brewing sugar, and with much greater care exercised all round in the manufacture of that article, that arsenical beer-poisoning had disappeared. Consequently, the outbreak which I have the honour of directing your attention to this afternoon is of special interest.

Among the cases admitted to the Halifax Poor Law Hospital at the beginning of the present year were some which attracted the attention of the house-surgeon as being very suspicious of arsenical poisoning. That being the case, he carefully looked through the patients he had in the hospital, and paid special attention to all new admissions. As a result of these investigations, some eight cases were discovered. These cases were carefully examined by the visiting staff of the hospital—viz., Dr. Woodyatt, the senior medical officer, and Dr. Shaw, as well as by a large number of outside medical men, including Dr. Reynolds of Manchester. While there was some difference of opinion expressed with regard to two or three of the cases, all were agreed that several of them undoubtedly suffered from arsenical poisoning.

I will, in the first place, give you notes of a few of the chief clinical symptoms in each case, for which I am indebted to the house-surgeon, Dr. Hodgson.

CASE 1.—W. N., male, aged eighty-four, a hawker, was admitted January 4th, 1902. He was filthy, and under the influence of drink. His face was puffy, there was some œdema of the feet, watery discharge from the eyes and nose, pigmentation of the skin of the neck, fading as it extended downwards over the trunk. There was pigmentation also in other parts of the body, the skin was peeling off the soles of the feet, the voice hoarse, absent tendon reflexes, there were dropped feet, and the calves were tender on pressure.

CASE 2.—T. L., male, aged fifty-four, carter, was admitted on January 15th, 1902, and was found to be suffering from shortness of breath, weak pulse, puffy face, watery eyes, hoarse voice, very marked pigmentation, being almost of a metallic blue-black on the

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back; the calves were tender, and the gait slightly ataxic. The tendon reflexes were absent. Arsenic was separated from his urine.

CASE 3.—L. L., female, aged fifty, was admitted on October 20th, 1901, suffering from diarrhoea, of which she had had several previous attacks. She was thin and weak; there was marked pigmentation, with normal patches of skin upon the brown background. The reflexes were very sluggish, and she had dropped feet.

CASE 4.—N. W., female, aged thirty-five, a silk-spinner, was admitted on October 8th, 1901, and had been ill at home for some time. She had been drinking beer up to her admission, of which her face was indicative. Her face was swollen, memory fogged, she was unable to walk, her feet were anæsthetic, and there were no tendon reflexes, but dropped feet, and much pigmentation of the skin.

CASE 5.—G. S., male, aged sixty-one, shoemaker, admitted November 14th, 1901, and was very anæmic. There was œdema of the legs and face, a trace of albumen, running eyes, and hoarse voice. There was marked pigmentation on the back, tenderness of the calves, dropped feet, keratosis, and mind was somewhat muddled. There were no tendon reflexes.

CASE 6.—W. H. M., male, aged fifty, admitted January 17th, 1902, with his face congested and puffy and his eyes watery. The skin of the chest was slightly pigmented and peeling. The feet were swollen, red, and peeling. He had noticed the nipple areolæ had gone darker lately. The tendon reflexes were exaggerated, the calf muscles very tender, the gait slightly ataxic, and there was incontinence of urine and fæces. Arsenic was found in the urine.

CASE 7.—L. W., male, aged sixty-five, a wire-cleaner, was admitted on January 10th, 1902. He was anæmic, the skin on the chest was mottled, there was tenderness of the calves, and slightly dropped feet. The gait was ataxic, the reflexes absent, and muscles wasted. There was well-marked keratosis of the skin on the palms of the hands and soles of the feet.

CASE 8.—J. W., male, aged forty-eight, a bookbinder, was admitted on March 1st, 1902, complaining of cramp in his hands and feet. The calves of both legs were very tender on pressure, and the soles of the feet, which were also red. The reflexes were very much exaggerated, and there was wasting of the muscles of the limbs.

Besides the above eight cases, some five others, occurring in private practice, came to my knowledge, but these I will pass over, simply contenting myself by merely mentioning the fact.

Of the above eight cases, three of them had been drinking beer from five different public-houses supplied by the same brewery, four of them from six houses supplied by another brewery, and three of them from three houses supplied by a third brewery; consequently, there was evidence that these patients had been in the habit of consuming beer from common sources.

Samples of beer were obtained, and submitted to analysis, with the result that two gave $\frac{1}{16}$ grain, one $\frac{1}{18}$ grain, one $\frac{1}{24}$ grain, one $\frac{1}{35}$ grain, one $\frac{1}{40}$ grain, three $\frac{1}{70}$ grain, and the rest less than $\frac{1}{100}$ grain per gallon.

These results certainly proved that arsenic was present in the beer, and in several cases in a dangerous quantity.

The next question which had to be determined was the source of the arsenic and how it found its way into the beer. With this end in view, samples of the various materials used in brewing were obtained and submitted to analysis, except flaked maize and flaked rice, which it was not considered necessary to examine. The samples of the various kinds of sugar gave satisfactory results, and were all practically arsenic-free.

The same is true with regard to the hops, and I was able to secure a sample from the same bulk as was used in brewing one lot of contaminated beer.

Samples of all the malts then in use were obtained, and they showed on analysis the presence of only $\frac{1}{2500}$ grain to $\frac{1}{20000}$ grain of arsenic per pound, which for all practical purposes were considered to be arsenic-free.

These being the facts brought out on investigation, the question still presented itself as to how the arsenic got into the beer. On carrying the investigations a little further in one case, I was fortunately enabled to obtain information which, I think, solved the problem.

My suspicions were particularly directed to brewer A, and I obtained samples from the bottoms of casks that had been emptied, and one of which had been brewed as far back as the beginning of November, 1901. These were found to be dangerously contaminated with arsenic.

This brewer obtained his malt from malster B. I found that B did not commence to make malt during season 1901-02 until December, 1901, hence all malt sent out by him—at any rate up to the middle of that month—was necessarily old malt. A had a consignment of malt from B early in October, 1901, and the bottoms of a cask brewed therefrom early in November gave on analysis $\frac{1}{20}$ grain of arsenic per gallon.

The next consignment of malt from B was early in December, 1901, and the following samples of beer brewed therefrom were obtained :

Samples.				Grains of Arsenic per Gallon.	
4 bottom of cask	$\frac{1}{8}$
169 beer	$\frac{1}{35}$
170 „	$\frac{1}{15}$
197 „	$\frac{1}{10}$

The next consignment of malt to A was in the end of December, 1901, and was mostly, if not all, new malt. The following samples were brewed from it :

Samples.				Grains of Arsenic per Gallon.	
174 porter	Minute trace.	
198 beer	$\frac{1}{120}$

The above facts go to show that it was the previous season's or old malt which was contaminated, for the brewings from the deliveries in October and early in December—both old malt—were arsenical to a dangerous degree, while that delivered late in December—which was new malt—produced beer practically free from the poison. Unfortunately, no samples of old malt could be had at any of the breweries, because it had all been worked off; but seeing that the malts that were used at the time were free, and that these patients must have been drinking arsenical beer for some considerable period, no other conclusion can very well be arrived at.

The question as to why malt made during season 1900-01 should be more arsenical than that made during 1901-02 naturally presents itself.

I need not tell you that in preparing malt it is placed upon a perforated floor of a kiln, through which the fumes from the burning fuel pass, and this is done because it is found that unless these fumes pass through in direct contact with the malt the flavour thereof cannot be obtained. That being the case, it follows that when fuel containing quantities of volatile arsenic is used the malt is certain to become contaminated.

The Manchester scare not only drew attention to the condition of the brewing sugars, but also brought out the fact that the malts being then used also contained in some cases excessive amounts of arsenic. Up to this time, and, in fact, during season 1900-01, I believe most malsters used gas-coke for fuel. It was pointed out that this class of coke was liable to contain large quantities of that

poison, consequently malsters began to look about for other fuel. Oven-coke was found to contain much less volatile arsenic than gas-coke, probably because it was driven off in the process of its manufacture. Specially chosen and picked anthracite coal was also ascertained to be less liable to contaminate the malt.

These facts led malsters pretty generally to adopt the use of either oven-coke or anthracite coal during season 1901-02, and this is the explanation of the greater freedom from arsenic of the malt made during the latter in comparison to that of the former season.

In conclusion, I should like for a moment to refer to the complaint which was frequently made during these investigations, as to the variation (sometimes considerable) in the results obtained by different analysts in the case of similar samples—for example, samples drawn from the same cask. This variation, I think, arises chiefly from four causes.

Firstly, the great difficulty experienced in getting reagents absolutely arsenic-free.

Secondly, differences in the methods adopted for the detection and calculation of arsenic.

Thirdly, these small quantities cannot be weighed, and have to be estimated, so there is a certain amount of error in judgment to allow for.

Fourthly, there may easily be a difference in the number of yeast cells present in different samples drawn from the same cask. Beer is drawn from near the bottom of the cask, where the sediment becomes deposited, and which consists to a very great extent of yeast cells. I can easily understand that the sediment will at times be more disturbed than at others, and more yeast cells thereby find their way into some samples than into others. Now, yeast cells take up arsenic, and, speaking proportionately, a fairly large quantity, as the following results of the analyses of the bottoms of beer casks will show:

Sample.		Filtered.		Yeasty Sediment.
1	...	$\frac{1}{30}$	grain	...
2	...	$\frac{1}{120}$	„	...
3	...	$\frac{1}{150}$	„	...

These figures, I should think, relatively to each other, are only approximations, because I imagine that neither the amount of yeast nor the amount of water in the sediment were calculated in any of the cases, consequently they are not sufficiently accurate to compare with one another; nevertheless, they are in my opinion significant, especially in the direction above indicated.