

BERI-BERI—AN INFECTED EUROPEAN CREW AT LEITH.

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RECENTLY, on the arrival of a large sailing vessel at Leith from Rangoon, it was found that of the crew, twenty-nine in number, twenty-five—namely, twenty-three Europeans and two natives—were suffering from beri-beri.

In 1901 a Commission was appointed by the Norwegian Government to inquire into the causes of the disease, and the precautions which should be taken to prevent its occurrence on board ship. The report of this Commission was translated by the Board of Trade, and submitted to a committee appointed by the Royal College of Physicians, London, for consideration and report.

The conclusion reached by this committee¹ was as follows:—
“The Norwegian Report, like so many other reports on the same subject, fails to give a precise answer to the question ‘What is the cause of beri-beri?’ and until this question is correctly answered, such practical matters as prophylaxis and treatment must continue, as heretofore, hazy and indefinite.”

To remedy this unsatisfactory state of matters, it is desirable that as much information as possible should be acquired concerning the disease. The relation of the circumstances under which this particular outbreak occurred should be of interest. The facts here recorded were ascertained from the captain of the vessel, a most intelligent and observant man, who was himself suffering from the disease on arrival at Leith, and from an examination of the ship's log.

(1) The ship was 164 days on the voyage from Rangoon to Leith, touching only at St. Helena. (2) The crew was entirely European, excepting two natives of India and one Japanese. (3) Only three Europeans and one native escaped the disease. (4) The ship left Rangoon on 16th June, and therefore during the early part of the voyage must have been exposed to the full force of the monsoon, causing the ship to be very “wet.” (5) The cargo consisted of 3600 tons of rice meal.

For two years previous to leaving Rangoon for home, the ship had been carrying general cargoes in the Pacific and Indian Oceans. There had not been any marked sickness on board. After leaving Rangoon, land was not touched until, on account of the condition of the crew, the captain was obliged to put into St. Helena on 22nd September.

¹ “Notice to Shipowners and Shipmasters,” Handbill 215, Board of Trade, June 1904.

On 9th September, *e.g.* seventy-six days after leaving Rangoon, one of the crew reported sick, complaining of swelling of the legs. Two days afterwards the Japanese member of the crew was unfit for duty, with the same symptoms. He, from previous experience, was able to inform the captain that he was suffering from kakke.

On the 15th September, four other men were on the sick list; and by the time St. Helena was reached (thirteen days after the first case occurred) almost the whole of the officers and crew were suffering from the disease. The vessel remained for ten days at St. Helena. The worst cases were sent to the shore hospital for treatment; the rest kept on deck under awnings.

On 1st October, the sick men having been sent back from hospital, the voyage was resumed, all the crew except two being (according to the log) fit for duty. During the two months' voyage to Leith there were several severe relapses, the first mate in particular being most seriously ill with cardiac symptoms. But eventually the ship was docked at Leith on 30th November, with the crew complete, none of the cases having ended fatally, but all the officers and most of the men still showed marked signs of the disease.

In contrast to this, the captain informed us that while they were lying at St. Helena, two other sailing vessels called there with beri-beri among the crew; in the one case, two men and the first mate, and in the other, eight of the crew, had died of the disease.

EXAMINATION OF OFFICERS AND CREW.—The crew were paid off directly the ship arrived, and there was little opportunity for examining them. It was noted, however, that a large proportion still showed signs of œdema.

The captain and first and third mates remained on board, and were carefully examined. The first named was found to be suffering from dilated heart; he walked with a hobbling gait, and exhibited all the usual signs of peripheral neuritis associated with beri-beri, especially in the left leg. There was marked anæsthesia and analgesia over most of the limb, but especially on the inner side of the foot and leg. About 3 in. above the ankle, completely surrounding the limb, was an area about an inch wide over which the most exquisite hyperæsthesia existed. The knee jerk on the left side was very much impaired.

The first mate still presented signs of œdema of the face, but was practically well. The third mate, one of the cases removed to hospital at St. Helena, still suffered from cardiac affection. There was epigastric pulsation, marked increase of dulness to the right, and, on auscultation, a peculiar irregular action, with systolic bruits and reduplication of the second sound at the base.

The crew appear to have chiefly suffered from œdema of the lower extremities, extending upward to the chest; none of them had œdema of the face. A large proportion suffered from cardiac

symptoms, and were rendered unfit for duty, not from symptoms of paresis, but from being, as expressed in the log, "short winded."

In view of Hamilton Wright's theory that the primary lesion is in the stomach and duodenum, careful inquiries were made to ascertain if the onset of the œdema had been preceded by gastric symptoms. This was found to be the case, the men attributing their dyspeptic symptoms to the water, which, though perfectly clear when put on board at Rangoon, very soon turned a "dirty yellow colour."

It may be well to state very briefly the various theories which have been advanced regarding the cause of beri-beri, and to consider if any of them would assist in determining the cause of this particular outbreak. The causes assigned may be divided into predisposing and exciting.

PREDISPOSING.—*Heat, moisture, and overcrowding.*—It is generally admitted that these factors influence the onset and spread of the disease. It is more prevalent in tropical and sub-tropical regions during hot moist weather, and often breaks out in the forecables of ships coming from hot climates through overheating on reaching colder climates.

The temperature on board this ship during the monsoon was doubtless high, and, owing to the rough weather experienced, it was also damp, but there was no overcrowding in the forecable, which was particularly airy and dry, and the quarters occupied by the officers were very dry and spacious.

A place disease.—This may be set aside in this case. The ship had been in the tropics for two years without any cases of beri-beri. It is interesting, however, to note that previously two other captains of the vessel had suffered from beri-beri while on board.

Want of nitrogenous matter and fat in the food.—The dietary was ample, and in excess of the Board of Trade requirements.

Want of fresh vegetables.—This is a cause often overlooked. A sailing ship cannot carry a supply of fresh vegetables sufficient for a voyage of three or four months, and lime juice and preserved vegetables are indifferent substitutes. There was marked improvement in all the cases when St. Helena was reached and a plentiful supply of vegetables obtained.

The Norwegian report quotes cases of the occurrence of beri-beri on board ships which had not been in the "endemic" area, or had any connection with infected parts. The London Commission was apparently sceptical on this point, but it is well known that cases of beri-beri are not infrequent on whalers when calling at St. Helena on their return from the south.

The influence of race.—As a rule, Europeans are less liable to attack than natives, but this case shows that, given the necessary conditions, they may suffer equally with natives.

EXCITING CAUSES.—There are many theories regarding the cause of the disease. Some, as those which ascribe it to the con-

sumption of stale or infected fish, or class it as a form of arsenical poisoning, need not be considered. Those worthy of consideration are—(1) The germ theory; (2) the toxin theory; (3) the rice theory; (4) the part played by insects.

Germs.—Several have been described as the active agent. Pekelharing and Winkler described a bacillus which they credited with a curious attribute, *e.g.*, that repeated infection by the bacillus was necessary to maintain the disease; they are said to have reproduced the disease by infection of lower animals with the bacillus. This view is not generally accepted. The Board of Trade advise restrictions in the use of tinned food, "70 to 80 per cent. of various kinds having been found to contain visible microbes."

Toxins.—Hamilton Wright, who has spent several years investigating the disease in the Malay Peninsula,¹ considers that the disease is due to a micro-organism which affects the stomach and duodenum, and, forming a primary lesion there, elaborates toxins which by dissemination throughout the body subsequently produce the nerve symptoms. In this respect he draws an analogy between this disease and diphtheria. He further states that the bacillus leaving the body in the faeces is re-introduced, not by any particular kind of food, but by food contaminated by contact with faecally polluted fingers or clothing. Unfortunately the bacillus is still a hypothetical one, as Wright has not been able to demonstrate its presence. Everything points to the disease being due to toxic matter of some kind, but whether it is elaborated by a micro-organism or not is at present pure conjecture.

Regarding the outbreak at present under consideration, whether the bacillus was present or not, faecal contamination of the food may, owing to the perfect sanitary arrangements on board, be set aside.

The rice theory.—The disease is specially prevalent in countries where rice forms a staple article of diet, and the possible connection between the consumption of mouldy or otherwise impure rice and the incidence of the disease has long been recognised. Lately, Travers, Wright, and others have endeavoured to prove, by extensive experiments on the feeding of prisoners, that this connection does not exist. On the other hand, other observers have brought forward instances to show that the disease may be due to the presence of either fungi or organisms in the rice, with the formation of ptomaines or toxins. This is recognised in ergotism and pellagra.

Clarke,² in the discussion on beri-beri at the last meeting of the British Medical Association, showed that Tamils do not suffer

¹ *Journ. Hyg.*, 1905, April; *Journ. Trop. Med.*, 1905, June 1; *Brit. Med. Journ.*, London, 1905, October 25.

² *Brit. Med. Journ.*, London, 1905, November 11.

from beri-beri even when living in a country where this disease causes one-third of the total deaths. He ascribes this to the fact that they boil their rice before husking it, while the Chinese use rice which has been husked raw, and may be "contaminated by a poison which lies in the husk."

The part played by insects.—It has been suggested that the virus of beri-beri may, as in yellow fever and other diseases, require an intermediate host for its proper development. Little work has been done in this direction, excepting a few inconclusive experiments with the ordinary bed bug, but it is quite possible that weevils (*calandra-olyzar*), beetles, cockroaches, and other insects may play a part either in the development of the active agent, or by acting as mechanical carriers of the infection.

"Rice meal," with which this vessel was loaded, is not, as the name would imply, a meal prepared by grinding rice, but is simply the husks and residue left in the process of husking; it is imported into this country to be used in the manufacture of feeding cake for cattle. When the hatches were opened, a most sickly, disagreeable odour was very apparent. The outer surface of the bags in which the meal was contained was covered with countless crawling insects, and a sample of meal taken at random showed them in large numbers. They were to be seen in all parts of the ship. Even in the officers' cabin they could be swept from the floor in handfuls. On examination, they were found to be small beetles about a quarter of an inch long. A thorough search of the ship for other insects was made by Mr. Evans, of the Natural History Department of the University, who has kindly furnished me with the subjoined list. It would be interesting to know if the presence of any of these insects has before been noted in connection with outbreaks of beri-beri.

1. BEETLES.—*Tribolium ferrugineum F.*, in enormous numbers, on bags, and all over ship. *Alphitobius piceus OL.*, plentiful. *Latheticus oryzae Wat.*, in small numbers.
2. COCKROACH.—*Periplaneta Americana*, in large numbers.
3. MOTH.—*Tineid*, species not determined; numerous.
4. SPIDER.—Not yet identified, common in dark corners about roof of the hold.

CONCLUSIONS.—The ship apparently became infected at Rangoon, but whether by an ambulatory case, or infected food, or cargo shipped at that port, is an open question.

The fact that both officers and men were affected points to some conditions on board common to all. These were—(1) Water supply, (2) weather conditions, (3) nature of cargo, (4) food supply.

(1) and (2) may be set aside—it is generally admitted that the disease is not carried by water; and the weather conditions, while they might tend to the spread of the disease, could not originate it.

(3) and (4). In an endeavour to account for this outbreak, which, owing to the number of Europeans affected, is somewhat unique, it is impossible to overlook the probability of its being due to the nature of the cargo and the presence of such enormous numbers of insects.

The food may have been infected when taken on board, and later it was probably infected by the insects, as, owing to their invasion of all parts of the ship, it was impossible to keep the food free from them.

I am indebted to Dr. Robertson, Medical Officer of Health at Leith, for affording me every opportunity of investigating the outbreak.

TYPHOID BACILLURIA.

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I. HISTORICAL.—Close on a quarter of a century has passed since the condition of typhoid bacilluria was originally described; but although so many years have elapsed, comparatively little attention has been paid to this highly important subject.

For long the stools have been looked on as the cause of the dissemination of typhoid or enteric fever, to the almost entire neglect of the urine. In 1873, Budd said:¹ "All the emanations from the sick are in a certain degree infectious. But at the same time it is one of the principal objects of this work to show that what is cast off from the intestine is incomparably more virulent than anything else."

Mention of the presence of bacilli in the urine of patients suffering from enteric fever appears to have been made first of all by Bouchard of France, at the International Congress of Medical

¹ "Typhoid Fever, its Nature, Mode of Spread, and Prevention."

TABLE NO. I.—*Showing Work done in period of Unreliable Bacteriology.*

Name.	Year.	Cases Examined.	Positive Results.	Per Cent.
Bouchard	1881	65	21	32·30
Hüppe	1886	18	1	5·55
Seitz	1886	7	2	28·57
Berlioz	1887	14	2	14·28
Koniaiev	1888	20	3	15·00
Neumann	1888	23	6	26·08
"	1890	48	11	22·91
Karlinski	1890	44	21	47·72
Silvestrini	1892	7	7	100·00
Barte de la Faille	1892	27	4	14·81
Wright and Semple	1892	7	6	85·71
Blumer	1895	60	2	3·33