AN OUTBREAK OF CLOSTRIDIUM WELCHII TOxin
FOOD POISONING

BY
Royal Army Medical Corps
AND
Lieutenant H. LISTER, M.B., B.S.
Royal Army Medical Corps

The Public Health Laboratory Service reports (1955 and 1956) show a steadily increasing annual incidence of notified food poisoning. *Clostridium welchii* caused only 1 per cent of all incidents, *i.e.* outbreaks, family outbreaks and sporadic cases, in 1956, but was responsible for 12 per cent of the total number of outbreaks, an increase of 3 per cent on the previous year's figures. One cannot say if this is a real increase or if it is due to improved notification. The specialised techniques required in laboratory diagnosis are now perhaps employed more often than in the past.

The majority of outbreaks of food poisoning due to *Cl. welchii* toxin have been caused, as might be expected, by heat-resistant strains (Hobbs *et al.*, 1953). Collee (1954, 1955) reported two outbreaks due to such strains, both of which occurred in the same barracks but at different times. Hobbs and her colleagues mentioned two outbreaks due to hæmolytic, heat-sensitive strains, in one of which braised beef probably became contaminated after cooking. This paper describes a large outbreak in a recruit unit caused by a hæmolytic, heat-sensitive strain of *Cl. welchii* in meat stew.

THE OUTBREAK

Diarrhœa of sudden onset occurred in men of two companies in the early hours of Friday, 30th November, 1956. The outbreak was mild and none of the cases was sufficiently severe to call out the medical officer until some hours later, when he saw 66 men at normal sick parade. By this time symptoms had abated and only a few cases required treatment. The only physical sign found was slight abdominal tenderness in a few cases; there was no pyrexia. Inquiries revealed that perhaps another 50 or more men had suffered minimal symptoms but did not report sick. This might have been due to a natural reluctance to forfeit the forthcoming week-end leave. These fears were justified as it was considered inadvisable to accept the risk, however slight, of disseminating infection to various parts of the United Kingdom.

It was soon evident that all cases had occurred in men of "B" and "C" Companies only, H.Q. and "A" Company being unaffected. Symptoms of all 66 men were listed; 58 had diarrhœa, 52 abdominal pain, three had vomited
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and only one complained of headache. These symptoms and the nature of the outbreak suggested food poisoning and attention was directed to the cookhouse shared by "B" and "C" Companies only. The total number at risk in these two companies was about 500.

Table 1 shows the number and type of specimens containing haemolytic Cl. welchii.

<table>
<thead>
<tr>
<th>Number investigated</th>
<th>Number of specimens</th>
<th>Number of positive specimens</th>
<th>Number of persons giving positive results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients (rectal swabs or faeces)</td>
<td>26</td>
<td>54</td>
<td>21</td>
</tr>
<tr>
<td>Meat stew</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Tinned peas</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

**EPIDEMIOLOGY**

**Source of infection**

The suspect cookhouse was visited and the previous day's meals were noted. It was found that of the 66 cases, 56 had lunch at twelve o'clock the previous day, all 66 had tea at five o'clock and only nine had the late supper meal. Many of the cases had snacks in the canteen later, but there appeared to be no common food factor. In view of these findings the tea meal was investigated in detail and it was found that meat stew was the main course. There had been no complaint about the taste or smell of this stew. Fortunately some was available, and a sample was sent the same day (30th November) to the Public Health Laboratory. Next morning (1st December) a telephoned report was received that Cl. welchii had been isolated from the stew. The stew had been prepared by adding tomato purée, peas and onions to fresh stewing beef. Unfortunately none of the tomato purée remained separate from the stew. This purée had been made up by adding tinned tomato soup to bacon rind and bacon bones; it was made immediately after the breakfast meal, heated up and then allowed to cool before being used to make the stew about five hours later. This would have been a very likely culture medium for Cl. welchii. None of the stewing beef was available apart from that in the stew, but the meat supply system was investigated later with negative laboratory results. Samples of the tinned peas added to the stew were also bacteriologically negative. The history of the meat supply is of interest; it had come from a central supply depot by vehicle four days previously. It was butchered and issued from the central butchery the day before being cooked. In the four-day interval mentioned above it had been stored in ice at low temperature, but the system of supply involves a fair amount of handling. It was not feasible to investigate all butchers and other food handlers associated with this supply system.
The cases

Rectal swabs or faeces were obtained from 26 of the 66 cases seen by the medical officer. A heat-sensitive hæmolytic Clostridium welchii, type A, was isolated from 14. The original strain from the stew was not typed, but as it was hæmolytic and heat-sensitive it was almost certainly type A. The onset of symptoms occurred in all cases between 4 and 6 a.m. on 30th November, which indicated an incubation period of 11 to 14 hours, and this, associated with mild diarrhoea and abdominal pain without pyrexia and an almost complete absence of vomiting, suggested the possibility of Clostridium welchii toxin as a cause rather than staphylococcal toxin. It was estimated that not more than 100 of about 500 men at risk had symptoms, which appears to be a low attack rate, but some of those apparently at risk may have eaten non-contaminated portions of stew (McClung, 1945).

Food handlers

Two of the six cooks in the cookhouse had symptoms and it was therefore decided to take all six off duty immediately, pending bacteriological investigation. All six were subsequently shown to have hæmolytic, heat-sensitive Clostridium welchii in their faeces. None was found to be excreting organisms of the salmonella or shigella groups. As the two affected cooks developed symptoms at the same time as the other cases and had both eaten stew at tea time the day before, it is clear that they, and probably also the four other cooks, who were symptomless excreters, derived their infection from the stew.

Other factors

A rodent problem existed in the camp at the time of the outbreak and there was some evidence of rodent infestation in the incriminated cookhouse. A further unusual feature was the presence of another animal species, a large beagle pack and two Alsatian guard dogs. The pack was housed in a wired compound in close proximity to the men’s living accommodation but at some distance from their cookhouse. The guard dogs were in a similar compound in a different part of the camp, also separate from cookhouses and at a distance from the beagles. It is likely that the rats were attracted by the dogs’ food and may have been the reservoir of infection. The rats were exterminated and dogs and hounds removed immediately. A final factor of some importance is that the outbreak occurred in recruits. Collee (1954) states that recruits appeared to be more severely affected. No permanent staff were at risk in this outbreak so a similar comparison is not possible. It is interesting to speculate what the effects, if any, would have been on older, regular soldiers.

DISCUSSION

Table 1 summarises the results of laboratory investigations. The noteworthy feature was the isolation of a hæmolytic, heat-sensitive Clostridium welchii from the stew and from 14 persons, all with symptoms, who had eaten it. Hobbs et al. (1953) isolated heat-sensitive organisms from two outbreaks in 1951. In one of these it was stated that the meat may have been contaminated after cooking. In the
present account it is suggested that the stew was contaminated before cooking, possibly by the tomato purée added to it, and that the cooking temperature was insufficient to prevent further bacterial multiplication. It is unfortunate that none of the tomato purée was left over for sampling. Some further samples of meat were also negative, but at this stage none of the original stewing beef was available. Collee (1955) isolated *Cl. welchii* from the unit butcher. It was not possible to investigate all the butchers and food handlers associated with this supply system, nor would it appear worth while, because *Cl. welchii* is commonly present in the faeces of normal people (Topley & Wilson, 1955). Good cookhouse technique must prevent bacterial multiplication and sporulation during cooking. This was lacking in the present outbreak. The tomato purée had been prepared soon after the breakfast meal, boiled, allowed to cool and then reheated in the stew several hours later. The stew itself had been prepared several hours before the meal and had been allowed to simmer slowly before it was served. Both Hobbs *et al.* (1953) and Collee (1954) stress the importance of proper cookhouse procedure and this outbreak supports this view. To prevent food poisoning due to *Cl. welchii* the following requirements are stressed: (a) Food should only be prepared immediately before it is cooked, (b) cooking should be as rapid as possible and at high temperature, (c) food should be served promptly with the minimum of handling and (d) reheated foods, especially meat gravy or stew, should not be used. These points are well known and are stressed in the training of cooks, but, like all discipline, require constant vigilance if they are to be effective. If this can be achieved, and it is eminently practical, then screening of possible carriers of *Cl. welchii* among cooks and food handlers is unnecessary. Hobbs *et al.* (1953) state that type A strains are frequently isolated from the faeces of normal people and from a wide variety of foodstuffs. In view of this and the frequent changes in cookhouse personnel, routine laboratory investigation of such persons is considered unnecessary.

There is wide variation in the figures reported for the time taken to kill spores of *Cl. welchii*. Headlee (1931) states that spores do not survive boiling at 100° C. longer than five minutes, whereas Zeissler & Rassfeld-Sternberg (1949) found that spores survived boiling for one to four hours.

With regard to the possible animal reservoir of infection, Hobbs *et al.* (1953) isolated *Cl. welchii* from mice, rats, dogs, pigs, cattle and flies. This emphasises the necessity of eliminating rodents and of removing dogs or other domestic animals from unit lines.

The suggestion that recruits may be more severely affected than others must be seriously considered. This applies in many infectious diseases and may be true of response to this enterotoxin also. Recruits come from a relatively sheltered family environment at the age of 18 years and are exposed in large numbers to a variety of organisms of which they may have had no previous experience. Training units such as the one considered here change over their recruits every six weeks, thus maintaining a constant influx of susceptible personnel. Strict application of food hygiene and proper cooking procedure is therefore of great importance.
A large but mild outbreak of toxic food poisoning due to heat-sensitive Cl. welchii (type A) is described, in which the symptoms were predominantly abdominal pain and diarrhoea.

Sixty-six out of 500 men at risk were affected, but many more milder cases did not report sick.

Six cooks were found to be excreters, but it was thought that they became infected through eating stew.

It is considered that as a heat-sensitive organism was isolated the method of cooking was at fault. The importance of improved cooking procedure rather than exclusion of carriers is emphasised.

The reservoir of infection might have been rodents and dogs in this outbreak.

We are indebted to Dr. G. Tee of the Public Health Laboratory Service, who carried out the bacteriological investigations, and would like to thank him also for his advice and assistance in preparing this paper.

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J. G. P. Power and H. Lister

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