STREPTOCOCCAL TONSILLITIS

An Explosive Epidemic

BY

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As a result of many investigations during the past twenty years, the spread of acute streptococcal tonsillitis, and of its twin, scarlatina, among large groups of men living together under barrack-room conditions is now recognized as taking place through the medium of dangerous, symptomless, nose-and-throat carriers and convalescent cases, and by the inadvertent contamination of their immediate environment [1, 2]. The healthy person may, after an attack of tonsillitis, remain for many months a carrier of pathogenic \( \beta \)-Haemolytic streptococci, and in this way perpetuate a high incidence of sporadic tonsillitis among a regimental community, which may include a large number of susceptibles. This endemicity is known to be further perpetuated by the regular introduction into the “universe” at risk of numbers of new arrivals [3] whose resistance to the prevalent streptococcal type may be low. This is in agreement with the results of similar observations on experimental animal populations [4].

During the past ten years several epidemics, involving men of one or other of the national armed forces, have been described in which an explosive outbreak of streptococcal tonsillitis has occurred among a relatively “closed” barrack population [7]. These epidemics have been distinguished by an abrupt onset, a high attack rate, by a low incidence of susceptibles among the remaining population, and by an origin in some article of food. They resemble outbreaks of scarlatina among civil populations, but are necessarily modified by the nature of the population attacked. They have further differed from the low-grade, air-borne epidemics by the apparently minimal virulence of the causative organism, so that cross-infection has been rare, complications few, and the termination of the epidemic sudden and spontaneous. Bloomfield and Rantz [5], who described an epidemic of this type, attributed these peculiar characteristics to massive infection by an organism of low virulence, while Wilson [6] considered that a high incidence of immunes among the population at risk was the more probable explanation.

A further explosive epidemic of the same type is described below.

During the early part of September, 1951, there occurred in a regiment in North Germany an outbreak of acute \( \beta \)-Haemolytic streptococcal tonsillitis. Of the 265 cases, 203 were seen during the first twenty-four hours. The epidemic was characterized by an attack rate of 35.5 per cent.
TABLE I.—TIME OF ONSET OF CASES WITH (a) THE NUMBER OF CASES FALLING ILL ON EACH DAY AND (b) THE NUMBER OF CASES REPORTING SICK EACH DAY

<table>
<thead>
<tr>
<th></th>
<th>(a)</th>
<th>(b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>August</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>31</td>
<td>33</td>
<td>1</td>
</tr>
<tr>
<td>September</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>136</td>
<td>83</td>
</tr>
<tr>
<td>2</td>
<td>52</td>
<td>120</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>18</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>On and after</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

The different distribution of figures is accentuated in the graph below.

Comparative graphs indicating the incidence of cases in the three outbreaks mentioned in the text. For tables of figures see Appendix.
Streptococcal Tonsillitis

TABLE II.—The composition of the regiment on the day preceding the outbreak of the epidemic, with the distribution of cases according to rank

<table>
<thead>
<tr>
<th>Rank</th>
<th>Number</th>
<th>Tonsillitis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Officers</td>
<td>29</td>
<td>0</td>
</tr>
<tr>
<td>Warrant Officers and Sergeants</td>
<td>61</td>
<td>0</td>
</tr>
<tr>
<td>Men</td>
<td>746</td>
<td>265 (35.5%)</td>
</tr>
<tr>
<td>Total</td>
<td>836</td>
<td>265</td>
</tr>
</tbody>
</table>

Causation

The causative organism was identified as a Group A \textit{Haemolytic streptococcus}. During the first day of the epidemic, the organism was isolated in pure culture from 9 of 12 throat swabs taken at random from among the initial 84 cases. Later the same organism was found both in pure and in mixed culture in other random cases. By the third day of the outbreak, when sufficient swabs were available to enable swabbing of every alternate case, treatment with chemotherapy or antibiotics had been started—the results of culture were thereby invalidated. In view of the almost identical clinical picture, there can be no reasonable doubt that one strain of streptococcus was responsible for the entire outbreak.

Some authors have reported sulphonamide resistance among the streptococci.

Clinical Features

Of the first 100 cases seen, the majority complained of sore throat, preceded by malaise, shivering, pains in the back and limbs, sweating, and pain in the neck. Less common symptoms included lower abdominal pain sufficiently severe to simulate acute appendicitis, occurring on the third day of the illness, mild meningism, chest pain, and mental disorientation. The majority of these symptoms were transient, but in one sporadic case seen shortly before the epidemic, continuous abdominal pain persisted with a normal temperature for five days.

Each of this initial group of patients had a high temperature, and was prostrate with malaise and the fatigue resulting from a night exercise. The tonsils were universally and grossly enlarged and covered by discrete follicular exudates, or by large ulcerated areas. Those cases who had had a previous tonsillectomy presented with a diffuse pharyngitis. Each case had local glandular enlargement of greater or less degree. The tonsillar glands were primarily involved, and generalized lymphadenopathy was not observed. The degree of glandular enlargement was not always an accurate reflection of the severity of the infective process. Those cases with ulcerative lesions of the tonsils appeared to suffer less pain than those with follicular exudates.

Later in the epidemic, the clinical picture became modified as cases of early or mild tonsillitis tended to report sick, and a complaint of sore throat was often unaccompanied by other symptoms. The temperature in these mild cases was seldom raised above 99°F.
It was possible on the basis of the severity of symptoms and signs to classify all cases into three broad groups. These groups represented (1) mild or abortive cases with few symptoms, a minimal rise in temperature and few signs; (2) a large group with well-marked bilateral follicular tonsillitis, glandular enlargement, and temperatures of 100°F and above; and (3) those cases of greatest severity—e.g., with peritonsillar abscess or swelling, with temperature of 104°F—and those cases with marked or prolonged systemic disturbance.

Of the 265 cases seen, 40 admitted to previous attacks of tonsillitis. The relative incidence among those who had undergone previous tonsillectomy was not determined.

**Epidemiology**

The epidemic involved a regiment of 836 men (Table II). Of these 29 were officers, and 61 warrant officers and sergeants. During the period from one week prior to the beginning of the epidemic to one week after its termination, there were no cases of tonsillitis among the two latter groups. The outbreak was therefore entirely confined to those men of corporal rank and less. The infection, however, did not appear to involve any one group of men either geographically, according to the position of their sleeping quarters, or chronologically, according to the time of their duty hours. The incidence of cases among the men was entirely random and was not limited to any single battery.

The significance of these observations is enhanced when it is noted that during the probable incubation period—i.e., 24-48 hours prior to the time when the majority of cases fell sick—both officers, warrant officers, sergeants and men were mixing freely on a night exercise.

The vehicle of infection must in other words be traced to a source common to all men in the regiment, but not to the officers, warrant officers, and sergeants. This source must be of such a nature as to offer a reasonable explanation of the simultaneous infection of large numbers of men.

Food and milk are recognized [5, 6] as being the probable sources of explosive epidemics of streptococcal tonsillitis, and in the epidemic described here these articles were again suspect. From the facts mentioned previously, airborne infection can be excluded, and a consideration of the way in which the epidemic started leads to the inescapable conclusion that a food or milk source was the cause of the epidemic.

Such a mode of spread presumes the contamination of food or milk by a healthy carrier or convalescent case. In other epidemics the nasal carrier has been cited as the dangerous excretor, particularly when suffering from acute upper respiratory disease. In the kitchen he may contaminate food or milk directly (particularly dangerous when the food or milk is allowed to stand long at a near-body temperature, permitting the organisms to multiply). Attention was, therefore, directed to the main kitchen and to the kitchen of the Naafi canteen. In the former it was observed that milk was prepared from powder or released from tins—the precautions observed to keep the milk clean were, however, adequate, and it was at once refrigerated. Containers were adequately washed but not sterilized. Food was handled freely by a total of thirty cooks. At the time of the
epidemic two of these had finger infections, and four had had sore throats during the preceding month—of these men one had had four attacks of sore throat in the preceding three months. Swabs from all four, however, revealed no pathogenic streptococci.

It was further observed that when the times of these attacks of tonsillitis among the cooks were plotted, an almost continuous period of one month was represented. That is to say, for four weeks prior to the main epidemic there had been a low-grade but continuous incidence of sore throat among the cooks.

<table>
<thead>
<tr>
<th>Cook</th>
<th>Dates</th>
<th>Cook</th>
<th>Dates</th>
<th>Cook</th>
<th>Dates</th>
<th>Cook</th>
<th>Dates</th>
</tr>
</thead>
</table>

Although this does not prove that a cook was indeed the source of infection, it is thought to be significant.

The conditions in the Naafi canteen were also investigated. Four civilian cooks were employed, none of whom had suffered from any form of upper respiratory disease during the preceding four weeks. Facilities for washing were adequate and the general standard of cleanliness high.

**Predisposing Factors**

Although some observers have postulated that an explosive outbreak such as this is caused by a massive dose of organisms of low virulence, it is tempting to assume that in this epidemic the passage of streptococci from one cook to another over a period of a month produced a strain of high local virulence but with a minimal capacity for spread. Proof of this is, however, lacking.

The resistance of the exposed population is another point having some bearing on the attack rate. The men had recently arrived from England, and were perhaps being exposed to an organism to which they lacked any acquired immunity, however little. Again, the men had been taking part in a strenuous night exercise; fatigue and sleeplessness may further have lowered their natural resistance.

These points are essentially speculative.

**Treatment [7, 9, 10, 11, 12]**

Cases were treated by one of three methods.

**Table III.—Number of Cases Treated by each Method, with the Average Time in Days Spent in Hospital**

<table>
<thead>
<tr>
<th>Method</th>
<th>Number</th>
<th>Average time in hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penicillin</td>
<td>108</td>
<td>6.2 days</td>
</tr>
<tr>
<td>Sulphamezathine</td>
<td>124</td>
<td>6.3 days</td>
</tr>
<tr>
<td>Penicillin and sulphamezathine</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Gargles and aspirin</td>
<td>33</td>
<td>8.2 days</td>
</tr>
</tbody>
</table>

This latter figure bears no direct relationship to the rapidity of response to treatment.
Of the initial 100 cases, one-third received saline gargles and 10 grains of aspirin every six hours; one-third received 1 gm. of sulphaemazine every six hours; and the remainder penicillin, once daily. While supplies were sufficient, penicillin was given in the form of a procaine and soluble mixture, to a total of 400,000 units per ml. Later one large dose (1 mega unit) of soluble penicillin once daily was used. Treatment continued in each case for five days. The progress of each case, and the condition of the throats, were reviewed daily by a medical officer. Temperatures were recorded once daily. Cases in whom the response to treatment was delayed more than five days were given the supposed benefit of penicillin in addition to whatever other treatment they may have been having. It was not felt justifiable to withhold the use of specific drugs longer in severe cases.

Those who developed peritonsillar abscesses were likewise given penicillin, as were those who displayed any of the toxic reactions to the sulphonamide drugs.

The later group of 165 cases was divided at random into those receiving penicillin and those having sulphamethazine.

By error, six cases received both penicillin and sulphamezathine (Table III). A full account of this trial of methods of treatment will be published later. Meanwhile the impressions gained as to the relative efficacy of each of these three methods are given below. It is emphasized that these impressions are without statistical authority, and do not provide an adequate basis for planning the treatment of future outbreaks.

The consensus of opinion formed from these results favours the use of penicillin for the average, moderately severe (Group 2) case of acute hemolytic streptococcal tonsillitis. This opinion is based on the following points:

1. Penicillin relieves the symptoms and subjective phenomena of the illness rapidly.
2. Penicillin lowers the temperature quickly.
3. With penicillin, recurrence of infection is rare, complications both of the infection and of the drug therapy uncommon.
4. One injection daily for four or five days is adequate.

Sulphamezathine is easier to give, and does not carry with it the risk of disease transmitted by a contaminated syringe. For treating the case of Group 2 severity it has, however, the following disadvantages:

1. It relieves symptoms less quickly than penicillin.
2. The infection is controlled less rapidly.
3. Complications both of the infection and of the drug therapy are more common than with penicillin.
4. Recurrence of infection is not uncommon.

The average period of sickness, however, for cases treated by these two rival methods does not differ significantly.
The use of saline gargles and aspirin in this type of case has nothing to recommend it: there was little subjective relief, the tendency to relapse was common and complications of the infection frequent.

The impression gained from the treatment of these cases has, therefore, upheld the suggestion that penicillin is the drug of choice in treating the moderately severe case of streptococcal tonsillitis, and that one injection daily is enough to prevent the likelihood of recurrence or relapse.

For the severe (Group 3) case, for the recurrent case or for those with peritonsillar abscess, this dosage of penicillin is probably minimal.

For the mild (Group 1) case either penicillin or sulphamezathine may be used and the results obtained are almost equally as good with either drug. Again, recovery of a mild case will usually take place rapidly when treatment is with saline gargles and aspirin tablets, but the tendency to relapse is greater than with the other methods of treatment and complications more frequent.

### Complications

#### Table IV.—The Incidence of Complications of All Kinds According to the Type of Treatment Used, Expressed as a Percentage of the Total Number Receiving Each Form of Therapy

<table>
<thead>
<tr>
<th>Complication</th>
<th>Gargles and Aspirin Per cent.</th>
<th>Sulphamezathine Per cent.</th>
<th>Penicillin Per cent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>All complications</td>
<td>27.0 [9]</td>
<td>8.0 [10]</td>
<td>4.6 [5]</td>
</tr>
<tr>
<td>Recurrence</td>
<td>2.9 [1]</td>
<td>4.8 [6]</td>
<td>0</td>
</tr>
<tr>
<td>Earache</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drug complications</td>
<td>0</td>
<td>0.8 [1]</td>
<td>0</td>
</tr>
</tbody>
</table>

(a) Of the Disease

Among the 265 cases there were 6 of peritonsillar abscess: 3 of these occurred among the men treated with gargles and aspirin (9 per cent.), 2 among the cases treated with sulphamezathine (1.6 per cent.), and one among the penicilln treated cases. In a further 7 cases recurrence of the infection took place two to seven days after discharge from hospital. These represented 2.9 per cent. of the gargle and aspirin treated cases and 4.8 per cent. of those having sulphamezathine. There were no recurrences among those having penicillin initially.

No cases of nephritis or of rheumatic fever were observed. This was in agreement with observations on previous similar outbreaks.

Nineteen men developed herpes febrilis. The incidence bore no relation to the type of treatment used.

Although two men complained of pain or deafness in the ear, there were no manifest cases of otitis media.

Meningism was noted in 3 cases.

(b) Of the Drug Therapy

In the absence of adequate skilled nursing attention, the fluid intake of sulphonamide-treated cases was probably minimal. One man developed
bilateral loin pain with temporary oliguria. He was treated by a restricted fluid intake of 1,000 ml. daily, and was transferred from sulphamezathine to penicillin. Recovery occurred rapidly.

LESSONS OF THE EPIDEMIC

It has been shown repeatedly that even in these relatively enlightened days one dangerous symptomless carrier of pathogenic organisms can still cause an immense amount of harm. In this epidemic at least, 2,000 working days were lost, the entire organization of the regiment upset, and the annual manoeuvres threatened. It is emphasized that this might have been avoided had health-consciousness been more dominant among the kitchen staff.

There is in fact great need for closer co-operation between kitchen and medical staffs; the significance of any minor symptom should at once be questioned. Kitchen staffs would do well to study the comprehensive medical organization employed by several large civilian caterers.

The control of such an explosive streptococcal epidemic is simple. These outbreaks we now know to be self-limiting, and it is sufficient merely to prevent [7] contact with the outside population and the grosser degrees of contact between patients and those not attacked, who are for the most part those whose resistance is high.

All infected cooks should be most carefully observed and three consecutive negative nose and throat swabs obtained before work is resumed.

SUMMARY

1. The mode of spread of epidemic streptococcal infections is mentioned. It is noted that during the past ten years several explosive food-borne epidemics of streptococcal tonsillitis have occurred.

2. A further explosive tonsillitis outbreak affecting a regiment is described—36 per cent. of the men in the regiment were involved.

3. The causative organism was a \( \beta \)-Hemolytic streptococcus.

4. The main clinical features are described—cases are classified broadly into three grades of severity.

5. The outbreak was limited entirely to those of corporal rank or below—reasons are given for believing the epidemic to have originated in the kitchen, probably from a cook.

6. Factors which may have lowered the resistance of the exposed population are described.

7. Treatment was by one of three methods—penicillin, sulphamezathine, or gargles and aspirin. Their relative merits are discussed, but not submitted to statistical analysis.

8. Complications are mentioned—their incidence in the different treatment groups is given.

9. Lessons to be learned from an outbreak of this type are detailed. Emphasis is laid on the necessity for improved co-operation between medical and kitchen staffs.
Streptococcal Tonsillitis

APPENDIX

Occurrence of Cases in Previous Epidemics

1. Bloomfield and Rantz (1943)

Day | Cases
---|---
1 | 135
2 | 156
3 | 37
4 | 5
5 | 8
6 | 0

Total | 341

2. Wilson (1944)

Day | Cases
---|---
1 | 4
2 | 42
3 | 25
4 | 8
5 | 5
6 | 2
7 | 2
8 | 1

Total | 89

REFERENCES


Corrigendum


Vol. XCVIII, No. 3, March 1952, page 191:

Table X: For “23” opposite “Totals” and under “Heterologous” (in column 10) substitute “14(23/164).”