AN ANALYSIS OF 422 CASES OF INFECTION
OF THE THROAT AND GUMS.

BY MAJOR T. CRAWFORD, B.Sc., M.D., F.R.F.P.S.
Royal Army Medical Corps.

INTRODUCTION.

This paper is an account of experiences in a Military Hospital in wards set aside for the admission and treatment of cases of acute and subacute infection of the throat and gums. The period covered is from January, 1941, to May, 1943, twenty-nine months. During that period 422 cases were treated. The admissions per month are given in Table I and shown graphically in the Chart.

Table I.—Monthly Incidence of Infection of the Throat and Gums.

<table>
<thead>
<tr>
<th>Year</th>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>S</td>
<td>V</td>
<td>Total</td>
<td>N</td>
<td>S</td>
<td>V</td>
<td>Total</td>
<td>N</td>
<td>S</td>
<td>V</td>
<td>Total</td>
</tr>
<tr>
<td>1941</td>
<td>5</td>
<td>5</td>
<td>8</td>
<td>18</td>
<td>3</td>
<td>8</td>
<td>17</td>
<td>28</td>
<td>5</td>
<td>2</td>
<td>12</td>
<td>19</td>
</tr>
<tr>
<td>1942</td>
<td>6</td>
<td>2</td>
<td>8</td>
<td>16</td>
<td>1</td>
<td>8</td>
<td>8</td>
<td>16</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>1943</td>
<td>7</td>
<td>3</td>
<td>2</td>
<td>12</td>
<td>1</td>
<td>9</td>
<td>5</td>
<td>17</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

N = Cases from which no specific organism was isolated.
S = Cases of hemolytic streptococcal infection.
V = Cases of Vincent's infection.
The cases may be classified on bacteriological grounds and subdivided clinically into the groups and sub-groups shown in Table II. The monthly incidence of the commoner groups is included in Table I and the Chart. The only striking features of these figures are the reduced incidence of the infections during the mild winter of 1942-1943 compared with the severe winter of 1941-1942 and the increased prevalence of Vincent's infection in the autumn of 1942. Unfortunately it is not possible to correlate these findings with the number of troops in the district at the different periods.

**Table II.—Bacteriological Classification and Clinical Subdivision of Cases. Average Age and Stay in Hospital. Occurrence of Proteinuria.**

<table>
<thead>
<tr>
<th>Condition</th>
<th>No. of cases</th>
<th>Average age (years)</th>
<th>Stay in hospital (days)</th>
<th>Cases of Proteinuria (per cent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diphtheria</td>
<td>8</td>
<td>24.4</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>No Specific Organism</td>
<td>76</td>
<td>25.7</td>
<td>9.8</td>
<td>17.1</td>
</tr>
<tr>
<td>1. Catarrhal Tonsillitis</td>
<td>40</td>
<td>25.3</td>
<td>7.4</td>
<td>10.0</td>
</tr>
<tr>
<td>2. Chronic Tonsillitis</td>
<td>33</td>
<td>26.6</td>
<td>12.75</td>
<td>27.3</td>
</tr>
<tr>
<td>3. Peritonsillar Abscess</td>
<td>3</td>
<td>27.1</td>
<td>13.1</td>
<td>—</td>
</tr>
<tr>
<td>Haemolytic Streptococcus</td>
<td>135</td>
<td>26.4</td>
<td>12.7</td>
<td>40.0</td>
</tr>
<tr>
<td>1. Simple Tonsillitis</td>
<td>101</td>
<td>26.6</td>
<td>12.0</td>
<td>35.6</td>
</tr>
<tr>
<td>2. Peritonsillar Abscess</td>
<td>34</td>
<td>25.9</td>
<td>14.7</td>
<td>52.9</td>
</tr>
<tr>
<td>Vincent's Infection</td>
<td>203</td>
<td>26.0</td>
<td>11.5</td>
<td>17.7</td>
</tr>
<tr>
<td>1. Tonsillitis</td>
<td>102</td>
<td>24.9</td>
<td>10.8</td>
<td>13.7</td>
</tr>
<tr>
<td>2. Gingivitis</td>
<td>71</td>
<td>26.0</td>
<td>12.3</td>
<td>18.3</td>
</tr>
<tr>
<td>3. Tonsillitis and Gingivitis</td>
<td>30</td>
<td>23.0</td>
<td>12.4</td>
<td>30.0</td>
</tr>
</tbody>
</table>

A.—Diphtheria.

The eight cases of diphtheria were removed from the wards immediately the diagnosis was established and are not further discussed here.

B.—Cases in Which No Specific Organism Was Isolated.

Cases in which no specific organism was isolated from the throat swab comprised 18 per cent of the total admissions. They were subdivided on clinical grounds into the following groups.

(a) Catarrhal Tonsillitis.—This condition is characterized by enlargement of the tonsils with generalized infection of the pharynx but without exudate or ulceration. It is probably to be regarded as a manifestation of the common cold. Of the present series of cases 40 fell into this sub-group. They showed slight or moderate pyrexia for one to four days and the condition resolved without specific treatment. The only treatment given consisted of carbolic mouth-washes and gargles and drugs of the aspirin group were given when headaches were troublesome. The average stay in hospital of these patients was 7.4 days.

(b) Cases of Chronic Tonsillitis with Subacute Exacerbation.—Thirty-three cases fell into this category. Many of them were already earmarked for tonsillectomy and the typical history was of a long succession of sore throats separated by shorter and shorter periods of freedom. It seemed that only by tonsillectomy was a lasting beneficial result to be obtained in these cases. On examination, the throats of these patients presented a variety of appearances. In some the tonsils were greatly enlarged, with prominent crypts often filled with caseous debris; in others they were small, fibrosed and irregular; while in a third group an intermediate condition of the tonsils was seen.

Treatment again consisted of carbolic mouth-washes and gargles but, in these cases, use was also made of direct applications to the diseased tonsils. Mandl's paint, 5 per cent chromic acid, 5 per cent silver nitrate and 10 per cent hydrogen peroxide were used at different times.

The average stay in hospital of these patients was 12.75 days but all were referred to the ear, nose and throat surgeon with a view to tonsillectomy.
(c) Peritonsillar Abscess.—Only three cases of peritonsillar abscess have been seen in which bacteriological examination has failed to reveal any specific causative organism. On clinical grounds these three cases were indistinguishable from the larger group of cases of peritonsillar abscess (vide infra) in which a haemolytic streptococcus was isolated. It seems probable that these cases were, in fact, due to haemolytic streptococcal infection but that the organism was lodged in the submucous cellular tissues and therefore inaccessible to the throat swab. In all these cases the abscesses subsided on chemotherapy, without discharging, so that no pus from the actual abscess became available for examination.

C.—Streptococcal Infection.

One hundred and thirty-five cases, or 31.3 per cent of the total admissions, come under this heading. They can be subdivided into cases of simple tonsillitis and cases of peritonsillar abscess.

(a) Simple Streptococcal Tonsillitis.—One hundred and one cases of this class have been seen and the average period of hospitalization was 12.0 days. Constitutional disturbance was, in most cases, severe with pyrexia reaching to 101–104° and lasting for a period of three to twelve days, though cases with more than six days of fever were unusual.

The tonsils showed various degrees of inflammation and the following stages were defined: (i) diffuse reddening and injection without exudate; (ii) exudate present at the mouths of the tonsillar crypts giving the typical spotted appearance of follicular tonsillitis; (iii) confluent exudate present over large areas of one or both tonsils, giving an appearance of false membrane.

Streptococcal exudate is easily detached by a swab and is usually readily distinguished from the greyer and more adherent membrane of diphtheria; in 16 cases however a doubt as to the nature of the condition led to the administration of diphtheria antitoxin before the result of the throat swab was obtained.

The stages listed above were not all seen in every case. Many patients were admitted in stage (ii) or (iii) while in other cases resolution occurred directly from stage i or ii and the more advanced features did not develop.

Treatment of these cases can be discussed under three headings—symptomatic treatment, local treatment and specific treatment.

Symptomatic treatment consisted largely in the administration of analgesic drugs of the aspirin group to relieve the headaches and muscle pains which were common concomitants of the condition. In cases with conspicuous or painful cervical adenitis antiphlogistic collars were often found to afford considerable relief.

Local treatment consisted of mouth-washes, which were used in all cases, and local applications to the tonsils which were employed in cases which did not receive specific treatment. The preparations employed in local treatment were the same as those used in the previous group of cases.

Specific treatment has consisted entirely in the use of drugs of the sulphonamide group; streptococcal antitoxin has not been used. Sixty-eight of the patients received chemotherapy, sulphanilamide having been used in thirty-six cases, sulphapyridine in twelve cases and sulphathiazole in eighteen cases. The usual precautions (administration of abundant fluids and alkali, frequent examination of urine and blood) were taken to guard against the toxic effects of these drugs. The drugs were given at four-hourly intervals, commencing with two doses of 2 grams each and continuing with 1 gram doses. The 2 a.m. dose was omitted after the first twenty-four hours if the patient was sleeping. Exhibition of the drugs was continued for twenty-four to thirty-six hours after the temperature had settled or for a maximum of six days. In only a few cases was treatment for more than four days required. In three cases, all receiving sulphapyridine, treatment had to be prematurely discontinued because of troublesome vomiting. In eight others (four sulphanilamide, one sulphapyridine and three sulphathiazole) it had to be discontinued because of the development of a considerable leucopenia. All these cases made uninterrupted recoveries.
Statistical assessment of the value of chemotherapy in streptococcal tonsillitis cannot be attempted from a consideration of these cases as there was conscious selection of the cases to whom the treatment was given—it was, in fact, withheld only from the milder cases. Based, however, on that notoriously inaccurate **bête noire** of scientific medicine—the clinical impression—the following "conclusions" are tentatively advanced:

1. Chemotherapy does not shorten the period of hospitalization of the ordinary mild case of streptococcal tonsillitis.
2. Chemotherapy is indicated in cases seen early with severe constitutional disturbance or with conspicuous cervical adenitis.
3. The most definite indication for chemotherapy is the presence of a considerable leucocytosis as shown by a white blood cell count above about 13,000 per c.mm. Such a leucocytosis probably indicates a spread of infection into the peritonsillar cellular tissue and the imminent development of peritonsillar suppuration.
4. Chemotherapy administered to severe cases reduces the incidence of complications—suppurative adenitis, suppurative otitis media and secondary peritonsillar abscess.
5. Chemotherapy causes more rapid disappearance of the **hæmolytic streptococcus** from the throat than occurs in untreated cases.

**Complications.** Suppurative complications have been surprisingly few among this series of cases. No case of suppurative otitis media occurred and in three cases only did a mild catarrhal otitis media develop. These cases quickly subsided on conservative treatment. Similarly there has been no case of suppurative adenitis. Secondary peritonsillar abscess (i.e. peritonsillar abscess developing in a patient having only tonsillitis when first seen) has occurred in seven cases and these have been included amongst other cases of peritonsillar abscess discussed below.

Though proteinuria (**vide infra**) has been a common finding in these patients, in only four cases has a diagnosis of nephritis been made. Two of these patients had previously suffered from the disease.

Four patients developed mild attacks of rheumatism eight to sixteen days after admission to hospital.

(b) **Peritonsillar Abscess.** Thirty-four cases of **hæmolytic streptococcal** peritonsillar abscess have been seen. The average stay in hospital was 14.7 days compared with 12.0 days for the cases of simple streptococcal tonsillitis. In twenty-seven of these patients the abscess was present on admission. The remaining seven cases, as pointed out above, were admitted with simple streptococcal tonsillitis and developed a secondary peritonsillar abscess after admission. The left side was affected in eighteen cases and the right side in ten cases while in six cases the affection was bilateral.

 Constitutional disturbance was similar to that seen in the more severe cases of simple streptococcal tonsillitis but local pain was of course much more severe and cervical adenitis was a constant feature.

Symptomatic and specific treatment were along the same lines as in the simple streptococcal tonsillitis cases. Eighteen cases received sulphanilamide, four sulphapyridine and twelve sulphathiazole. Cyanosis was often a marked feature with sulphanilamide and vomiting was troublesome in five of the other cases but in none was it necessary to discontinue treatment before the desired course had been given; and in no case did the leucocyte count fall to dangerously low levels.

Local treatment consisted of the following measures:

1. The use of carbolic and bicarbonate gargles given as hot as the patient could tolerate.
2. Spraying and syringing with the same solutions. This was used after the abscess had discharged or been incised.
3. Incision of the abscess. This operation was resorted to in only ten of the cases and was performed by the ear, nose and throat surgeon to the hospital. It was reserved for cases seen late in the disease, in which a considerable quantity of pus had formed and had not discharged spontaneously, and for cases in which the accumulation of pus continued in spite
of chemotherapy. Of the twenty-four cases treated without incision eight showed spontaneous discharge of the abscess while in the remaining sixteen cases the abscesses resolved without discharging.

Statistical assessment of the value of chemotherapy from consideration of these cases is again impossible, owing to the absence of an untreated control group. The facts that in none of these cases did the suppuration spread beyond the peritonsillar region and that no other complications were seen, lend strong support, however, to the now widely held view that chemotherapy is a valuable weapon in the treatment of peritonsillar suppuration. It seems clear that by its use operation can be avoided, in the great majority of cases seen early, and that the incidence of many of the dangerous sequelae of the condition can be reduced to a minimum.

Of the thirty-four cases of peritonsillar abscess seen, twelve were recommended for tonsillectomy at a later date because of the persistent unhealthy state of the tonsils combined with a history of frequently recurring sore throats.

D—VincEKT'S INFECTION.

The diagnosis of Vincent's infection has been based upon a combination of clinical and bacteriological findings. Clinically the cases included in this section have all been characterized by the occurrence of typical sloughing necrotic ulceration of the gums or in the region of the fauces or in both these sites. A distinctive and unpleasant factor of the breath is an additional diagnostic feature. The diagnosis has been confirmed in all cases by the microscopic examination of stained smears of the necrotic material. It is important that these smears should be made before treatment is commenced as the diagnostic appearances may be lost within a few hours of a single application of such antiseptics as chromic acid or silver nitrate. It is also important to realize that bacteriological diagnosis depends upon the finding of the spirochaetes and fusiform bacilli (Vincent's organisms) in large numbers—easily outnumbering any other bacterial forms that may be present. The mere finding of a few spirochaetes and fusiforms amongst a preponderance of other forms is by no means diagnostic though this is the appearance frequently encountered in true cases of Vincent's infection after treatment has been commenced. Swabs have also been examined for the presence of the haemolytic streptococcus and this organism has been found as a not uncommon concomitant of the infection.

In all, 203 cases of Vincent's infection have been seen, forming 48·1 per cent of the total admissions to the ward and constituting the largest single group. These cases may be subdivided according to the distribution of the ulceration.

(a) Cases with Tonsillitis Only.—102 cases, or 50 per cent of the cases of Vincent's infection, fall into this subdivision. The average period of hospitalization was 10·8 days. The ulceration was bilateral in 28 cases, right sided in 36 cases and left sided in 38 cases.

Pyrexia after admission to hospital was present in less than half the cases (47·5 per cent) and it was a striking fact that the degree of constitutional disturbance appeared to bear no direct relationship to the severity of the faucial lesions. In 22·5 per cent of these cases a haemolytic streptococcus was isolated in culture from the throat swabs in addition to the findings of a preponderance of Vincent's organisms in the stained smears of the necrotic material. As the clinical features of these cases with mixed infection were entirely those related to the Vincent's organisms the cases have been classified in this group only. Constitutional disturbance in these cases of mixed infection was no more severe than in the remainder of the group and pyrexia occurred in only a slightly larger proportion (51 per cent as compared with 47·5 per cent for the whole group). In short the addition of a haemolytic streptococcus to a case of Vincent's infection did not seem to increase the severity or the duration of the disease.

(b) Cases with Gingivitis Only.—Seventy-one cases of Vincent's infection were seen in which the ulcerative process was limited to the gums. The disease was almost invariably associated with abnormalities of the teeth or gums, the most frequent underlying lesions
being (i) extensive dental caries; (ii) the presence of flaps of redundant gum tissue usually overlapping an erupting molar or at the site of a recent extraction; (iii) overcrowding of the teeth with the formation of irregularities and pockets in the gum margin and (iv) the presence of large collections of tartar around the necks of the teeth.

In a small number of cases, however—the number has not been accurately recorded—the infection occurred in an apparently healthy mouth. In these cases the gums in the upper and lower incisor regions were involved and the appearances certainly suggested direct implantation of the infection at these sites. Such implantation could occur by the use of infected drinking mugs or in the act of kissing.

Constitutional disturbance in most of these cases was slight and consisted for the most part of nausea and debility with, sometimes, headache and constipation. Pyrexia was present after admission to hospital in only nineteen cases (28·8 per cent).

(c) Cases with Tonsillitis and Gingivitis.—Thirty cases were seen in which the ulceration involved the fauces and gums simultaneously. The commonest sequence of events appeared to be for the infection to spread back to the fauces from an infected gum flap over an incompletely erupted lower posterior molar tooth. In this connexion it is interesting to note that the average age of this group is somewhat lower than that of any of the other groups (see Table II). In other cases, however, no such direct connexion between faucial and gingival infection could be made out.

Nine of the cases (30 per cent) showed the presence of secondary haemolytic streptococcal infection, noted above as occurring in 22·5 per cent of the cases with tonsillitis only.

**TREATMENT OF CASES OF VINCENT'S INFECTION.**

Infected patients were isolated and debarked from communal feeding places during the active period of the disease. General treatment consisted of rest in bed during the febrile period with administration of a good mixed diet. Ascorbic acid was given in quantities of 150 mg. a day during the period in hospital. This was done not in the belief that the condition was due to a vitamin deficiency—in fact a group of eleven cases investigated showed no evidence of deficiency—but because the opinion is now widely held that these infections heal more rapidly when an excess of this vitamin is present in the tissues.

Local treatment has varied from time to time and many different applications have been tried. Silver nitrate (2 per cent), chromic acid (5 per cent), zinc sulphate (2 per cent) and hydrogen peroxide (10 per cent) have all been used with success. Local applications of neoarsphenamine (N.A.B.) solutions gave inferior results. The method at present in use is to swab the ulcerated regions with 5 per cent chromic acid solution and to follow this with a hydrogen peroxide wash. This is done once to thrice daily according to the severity of the condition. In the gingivitis cases the toothbrush in use is destroyed on admission and a new soft one is provided when all ulceration accessible to the brush has healed. These cases are also seen by the dental officer to the hospital who carries out treatment directed at removing the dental abnormalities mentioned above which so frequently are responsible for persistence and relapse of the condition. In a few of the more chronic cases packing of the gums with zinc oxide and clove oil paste has been used by the dental officer with good results.

Specific Treatment.—There is a fairly widespread belief that treatment with neoarsphenamine and allied arsenical preparations, either by local application or by intravenous injection, has a specific curative action against Vincent’s infection. Neoarsphenamine (N.A.B. in aqueous solution) was used as a local application in 34 of the earlier cases of this series but the impression was formed that it was definitely inferior in its action to oxidizing agents such as chromic acid so that its use in this way was discontinued. Intravenous injections of N.A.B. in doses varying from 0·3 to 0·6 gram were given to 124 of the severer cases. The results observed were conflicting. In many cases of tonsillitis pain was relieved and the lesions ceased spreading and soon began to heal but in other cases the injection seemed to be without any obvious effect on the course of the disease. In cases of gingivitis N.A.B. injections seldom seemed to cause noticeable benefit though occasionally spread of the ulceration may have been checked.
In general it may be said that N.A.B. injections though sometimes having a beneficial effect on the course of the disease take second place to efficient local treatment in dealing with both gum and tonsil infections. In this connexion it is interesting to note that four cases have been seen in which typical Vincent’s infections (two gingivitis; one tonsillitis and one combined tonsillitis and gingivitis) developed in patients actually undergoing courses of N.A.B. injections for syphilis.

This series of cases has provided no support for the idea that a nutritional deficiency underlies Vincent’s infection. As mentioned above, eleven cases investigated by the ascorbic acid saturation test showed no evidence of vitamin C deficiency. Another small group of cases was given nicotinic acid by mouth and intravenously but derived no benefit from this treatment.

Circumstantial evidence of infectivity was obtained in many ways. Several groups of cases from a single billet were seen and many cases gave a history of contracting the infection while on leave, their wives having been suffering from bleeding gums prior to their arrival.

**THE OCCURRENCE OF PROTEINURIA (ALBUMINURIA).**

The urine of all patients was examined the morning after admission to hospital and daily while receiving chemotherapy. The occurrence of proteinuria in the various groups of cases is shown in Table II and compared with the rate in one thousand successive admissions to the orthopaedic and ophthalmic wards of the hospital, the tests being performed by the same technicians. It will be seen that the greatest incidence was in the peritonsillar abscess cases and the lowest amongst the cases of catarrhal tonsillitis. Among the Vincent’s cases the incidence of proteinuria bears a direct relationship to the extent of the ulcerated area. All groups except the cases of catarrhal tonsillitis show a significant increase above the incidence of proteinuria amongst the control group of surgical non-renal cases.

**DIFFERENTIAL DIAGNOSIS.**

There are three conditions for which a sharp lookout must be kept by any medical officer dealing with cases of oral and pharyngeal infection. The first of these—glandular fever or infective mononucleosis—is not uncommon. The other two—acute leukaemia and agranulocytic angina—are relatively rare. During the period under review twenty-four cases of glandular fever and one case of acute myeloblastic leukaemia have found their way into the wards with a primary diagnosis of throat or gum infection. No case of true agranulocytic angina has been seen.

Mistakes and delays in the diagnosis of these conditions will be avoided if the following indications for total and differential white cell counts are observed: (1) Lymph gland enlargement extending beyond the anterior triangle of the neck. (2) Failure to isolate a pathogenic organism from the throat swab in spite of the presence of faecal exudate—a common finding in glandular fever. (3) Unduly prolonged pyrexia. (4) Extension of ulceration beyond the usual sites.

In addition, it is important to bear in mind that a swab positive for Vincent’s organisms or haemolytic streptococcus does not exclude the possibility of a more serious underlying pathology. The case of leukaemia and nine of the cases of glandular fever mentioned above showed swabs positive for Vincent’s organisms on admission.

**SUMMARY.**

An account is given of 422 patients treated during a period of two and a half years in wards set aside for cases of throat and gum infection. The cases have been grouped on bacteriological findings and subdivided on clinical grounds. The treatment employed has been described and the impressions formed recorded. Unfortunately these are only impressions for control groups were not used. The occurrence of proteinuria, which was surprisingly high in some groups, is summarized in Table II. The importance of white blood cell counts in diagnosis is stressed.

I would like to thank Colonel Wallace Benson, C.B.E., D.S.O., for his help and for permission to forward this paper.