DIPHTHERIA—THE "BULL NECK" HYPERTOXIC TYPE. A MIXED INFECTION.

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The cases of diphtheria shown to be a one-organism infection of the Klebs-Loeffler bacillus, whether the tonsils and fauces, the pharynx, the larynx, or the nose are the primary site of infection, no longer constitute the bogey to the medical profession, as they did about half a century ago.

The great change follows the progressive strides made by medical science during late years:

1. By the introduction of serum therapy and, more especially, by the still later method of employing the intravenous route, together with intravenous glucose with or without the requisite dose of insulin.

2. By the equally valuable improvement in bacteriological technique, making possible an earlier diagnosis, by the staining of the organism in direct smears, by the employment of media for culture (Loeffler's blood serum or Hoyle's laked blood tellurite agar), by the sugar fermentation tests and, lastly, by using the guinea-pig for testing the virulence of the organism.

3. By the use of the Schick test for susceptibility and the ensuing immunization of those showing a Schick-positive reaction and the general immunization of all young children without any preliminary Schick test.

Diphtheria has thus lost its scare—in fact one is relieved of all fear of the disease—and there is little or no cause why any case should be lost, given that the diagnosis is made within the first two or three days.

In these "true-bill" diphtherias, the clinical diagnosis presents little or no difficulty and it is almost constantly backed by the bacteriological findings.

This happy state of affairs does not exist, however, in cases in which there is a mixed infection, that is where, in addition to the presence of the Klebs-Loeffler bacillus, there are other organisms whose mere presence blots out from view the reasons, clinical and bacteriological, for appreciating the existence of the diphtheria bacillus as a causal agent in the case.

It is in these mixed infections that we are still truly up against it, and the reason for it is the great difficulty in arriving at the correct early diagnosis. In this type of case there is often absolutely nothing to lead one to suspect the presence of the diphtheria organism. In fact, the therapeutic test may be the only real proof that the case is diphtheria.

The organisms that generally appear in the laboratory reports are (1) The *Streptococcus hemolyticus*, at times giving a pure culture; (2) The *staphylococcus*; (3) The *pneumococcus*; (4) The *Micrococcus catarrhalis*; and (5) Vincent's organisms.
Diphtheria—The "Bull Neck" Hypertoxic Type

The throat is nearly always negative to the Klebs-Löffler bacillus in the first swab and, in many cases, throughout the whole of the disease. In some cases there is no membrane present or at any rate visible.

The most frequent errors made in diagnosis are mumps, quinsy, follicular or ulcerative tonsillitis or merely "sore throat," syphilitic ulceration, Ludwig's angina, Vincent's angina or scarlet fever, which may indeed co-exist and present a bull-neck appearance.

In these cases it is essential to realize that the time factor is everything in saving life, by the early administration of antitoxin. Every hour counts and consequently one does not wait for confirmation by the Schick test or the laboratory report. In any case, the Schick test will be negative if performed after antitoxin has been given. The diagnosis often must be on purely clinical grounds and the correct procedure undoubtedly is to administer the antitoxin and accept the lesser of two evils. Confirm the diagnosis later by taking nasal and throat swabs but treat the case first.

The Clinical Picture of "Bull-Neck" Hypertoxic Diphtheria.

The patient complains of sore throat and difficulty in swallowing, so different from the case of pure diphtheria, neither has he the languid and apathetic expression and toxic appearance of the latter. On the contrary, his face is flushed and suggestive of fever, he is probably perspiring and has some dyspnœa and dysphagia and he has a fetid breath to the point of being extremely putrid and offensive. This is very characteristic. The lips may be cracked and dry, with herpes and, possibly, a sanious nasal discharge with blood-stained saliva trickling from the mouth. This latter is not by any means constant.

The title "Bull-Neck" truthfully describes the anatomical picture as it closely resembles the neck of the bull. There is a hard, tense swelling of the neck, obliterating the normal outlines, stretching from the angle of the jaw downwards on one or both sides. This is due to a cellulitis of the tissues of the neck and, once seen, is not forgotten. It has a distinctly different feel from an ordinary cervical adenitis, that of laying one's hand on a billiard ball with no sense of fluctuation or elasticity. Together with this, cellulitis is frequently present, a definite quinsy or peritonsillar abscess. With it all, one may be able to appreciate a swelling of the submaxillary glands, those at the angle of the jaw or those of the anterior cervical group.

On looking into the mouth, which can only be partially opened and that with difficulty and pain, the oropharynx is brightly injected, the tongue is of the streptococcal type, i.e. scarlet red and possibly fissured, denoting a very acute inflammation, with œdema of the soft palate and uvula. In fact, the whole of the mouth and pharynx displays a condition of catarrhal congestion so intense that one wonders how the patient can breathe or swallow; and one considers the possibility of a tracheotomy at a later date. The patient is frightened that he will choke and he should be reassured that this cannot happen and that he will feel much better when the "abscess" breaks. The use of a scalpel or bistoury is not indicated. The fauces and tonsils may be spotted and patchy but a definite
area of membrane is seldom visible. The temperature ranges from 101° to 104° F., the pulse is rapid, from 110 to 120 or more, and it is generally soft at the wrist. There will nearly always be albumin in the urine—from a mere trace to complete solidity on boiling. There is no haematuria and the kidney condition may clear up in a few days.

Here we have a picture of this type of mixed infection seen in the early days. If not diagnosed early, the patient’s condition rapidly deteriorates and profound toxæmia ensues, with prostration and intense greyness and toxic appearance and lethargy with possibly purpuric haemorrhages on the trunk and limbs, and death takes place from cardiac failure in about six days. If seen late, the patient does not react to even large doses of antitoxin introduced by any route.

There have been ten such cases admitted to this hospital, nine of which were, in the first instance, wrongly diagnosed, and it is submitted that an abridged analysis of these cases might with advantage show some of the difficulties met with in establishing an early diagnosis.

**History Before Admission of the 10 Cases Enumerated.**

1. Treated for six days with sulphanilamide for “sore throat.” Laboratory report on throat swabs negative for K.L.B., Vincent’s and haemolytic streptococci.
2. Treated for tonsillitis for five days.
3. History of “sore throat and general weakness” for two days.
4. Diagnosed as diphtheria and sent to hospital immediately.
5. Originally diagnosed as ulcerative tonsillitis and later as “mumps” and later still as diphtheria and given 8,000 units of antitoxin before admission.
6. History of quinsy, having ruptured on day previous. But as there was no improvement in the general condition he was sent to hospital.
7. Sent to Sick Bay for one and a half days with swollen glands, then diagnosed as “quinsy” and sent to this hospital as “mumps.”
8. Had been in contact with a case of diphtheria and diagnosed as diphtheria, and 8,000 units of antitoxin given before admission.
9. Diagnosed as tonsillitis and Vincent’s angina and treated with sulphanilamide.
10. A soldier’s child, aged 5, diagnosed as “mumps,” but medical man not called in for over a fortnight. Her throat swab was reported as strongly positive K.L.B. and haemolytic streptococcus. She was admitted to hospital and died the next day.

**Laboratory Reports on Throat Swabs.**

The first swab was negative in nine out of the ten cases and, in eight of the ten cases, was negative throughout the disease. In one case morphological K.L.B. was isolated on the third day and in another not until the fourteenth day though six swabs were sent and all previous reports were negative for K.L.B., Vincent’s and haemolytic streptococci. The organisms most commonly reported as present were Vincent’s and haemolytic streptococci.
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Fetid Breath.—Diagnostic in severer cases.

Temperature.—Raised from 100° to 104° in all cases but one in which the temperature was normal throughout.

Contour of Neck.—All cases possessed the "Bull-Neck" outline.

Quinsy.—Present in six cases.

Membrane.—Definitely present in five cases; others had a mucopurulent exudate on one or both tonsils.

Blood Picture.—Not constant; but those in which a differential blood count was done showed a polymorphonuclear leucocytosis.

Generalization.—100 per cent had the "bull-neck" appearance due to cellulitis with or without quinsy. 70 per cent had the diagnostic unforgettable fætor of breath. 90 per cent had a temperature of 100° and over.

Differential Diagnosis:

Vincent's Angina.—The direct swab shows the fusiform bacilli with a motile spirillum. Further, there is nearly always present an extensive ulceration of the gums with a purulent discharge.

Mumps.—In "bull-neck" diphtheria the parotid is not involved and even the sub-maxillary type of mumps is easily distinguishable.

Quinsy.—Very frequently present but, in addition, there is the extensive cellulitis, the fetid breath and the "bull-neck" appearance.

Follicular Tonsillitis.—The area infected is much beyond what is present in a case of tonsillitis. In addition, there is the diagnostic breath, the cellulitis and general engorgement of the throat.

Retro-pharyngeal Abscess.—The site of this is generally diagnostic by its position, in which it forces forward the posterior pharyngeal wall, "blocking up" the throat. Further, fluctuation is easily recognized by examining the posterior wall of the pharynx with the finger.

 Scarlet Fever.—The history of vomiting, the rash and red strawberry tongue, which may have begun to peel, and the angry redness of the whole of the fauces in early scarlet fever are diagnostic, and the absence of the fætor in diphtheria is helpful.

Ludwig's Angina.—There are many similarities in these two infections but angina ludovici is a very severe septic inflammation giving rise to a temperature of 105° or 106°. It is a streptococcal infection of an extreme degree of virulence, in which death may result from asphyxia within twenty-four hours of the onset of the disease. There is absent the diagnostic fætor.

Syphilitic Ulcerations.—These are generally situated well forward and even on the hard palate. There may be a history of syphilis. The case does not react to anti-diphtheritic serum but reacts to mercury and iodide.

Tubercular Ulceration.—There is a chronic history and probably tuberculosis is found elsewhere.
TREATMENT OF THE MIXED INFECTION.

The most morbid element being the Klebs-Loeffler bacillus, the patient should be transferred without delay to an isolation hospital.

The following recommended treatment is as carried out in this hospital:

(1) If an Army case, put on the Dangerously Ill List and notify the disease.
(2) Put the patient recumbent and block the foot of the bed.
(3) Take a nose and throat swab.
(4) Give 12,000 units of diphtheria antitoxin intravenously. Give it slowly and watch the reaction.
(5) Give 50,000 to 100,000 units of antitoxin intramuscularly, the dose depending on (a) the condition of patient and extent of membrane, if present, and (b) length of time since commencement of illness.
(6) Give 40 to 60 c.c. of 40 to 50 per cent glucose intravenously. The equivalent amount of insulin may be given; but latterly it has been considered unnecessary and without advantage.
(7) Order glucose by the mouth *ad lib* up to 5 oz. daily.
(8) If there is a quinsy or much cellulitis, order a linseed meal or kaolin poultice to be repeated six-hourly.
(9) In ordinary nursing activities the mouth will be kept clean and freed of exudate.
(10) (4), (5) and (6) may have to be repeated the next and even the third day.
(11) A good method to follow after the third or fourth day is to give a morning and afternoon intramuscular injection of 24,000 units of antitoxin until all membrane is separated, if present, or until the patient's temperature is normal and the process of intoxication has obviously come to an end.
(12) If the Laboratory reports the presence of haemolytic streptococci in any number, give 3,000 units of concentrated anti-streptococcal (haemolytic) serum intramuscularly and repeat the next day.
(13) If Vincent's organisms are reported, paint the throat twice daily with 2 per cent chromic acid followed by a peroxide mouth-wash.

The amount of antitoxin given to the ten cases analysed:

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<th>Case</th>
<th>Units intravenously</th>
<th>Units intramuscularly</th>
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<tr>
<td>1</td>
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<td>8</td>
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<td>10</td>
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PROGNOSIS.

In the days before the introduction of antitoxin therapy the mortality ranged from 25 to 40 or 45 per cent and the figure for the hypertoxic variety, was, and
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still is, given as 50 per cent. To-day, a fair estimate of straightforward diphtheria cases would be a mortality rate of from 3 to 10 per cent.

In this Hospital there have been admitted 239 cases of diphtheria since the outbreak of war and of these four died, which gives a mortality rate of 1·6 per cent of all cases. Out of the ten cases analysed, two died (included in the above-mentioned four deaths) giving a mortality figure of 20 per cent. The two cases who died were those numbered 1 and 10.

It is a logical deduction that the cause of the great difference of the mortality figures between the true diphtheria cases and the “bull-neck” mixed infection must be the great difficulty in establishing an early diagnosis in the type of case analysed above.

The bacteriological work was done by the Assistant Directors of Pathology of this Command and I would render thanks for their unfailing co-operation at all times. They are Lieutenant-Colonel Little, O.B.E., and Lieutenant-Colonel M. T. Whitehead, M.C.

Apart from the serum treatment, the general management of the case by the Nursing Staff influences the prognosis immensely and I do with great pleasure pay tribute to the excellent and untiring care bestowed on every patient by the Nursing Members of Q.A.I.M.N.S. and Q.A.I.M.N.S.(R).