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THE CONTROL OF POST SCARLATINAL DIPHTHERIA
WITH SPECIAL REFERENCE TO THE "CARRIER"
PROBLEM IN DIPHTHERIA.

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The paramount importance from a Public Health standpoint of the occurrence of post-scarlatinal diphtheria and of its causative agent the "carrier" has become more and more apparent since attention was first drawn to the "carrier" question in the case of enteric fever. And if these apparently ^{recovered} (well) enteric patients have been responsible for the occurrence of many outbreaks of enteric fever, everything points to the diphtheria "carrier" being, in its effect, a much more potent and harmful agent.

Diphtheria is an infectious and contagious disease caused by a specific bacillus which shows a marked aptitude for growing and existing for long periods - with or without producing marked constitutional symptoms - on any mucous membrane of the body and when this bacillus can be isolated and demonstrated microscopically, when it is found to produce certain chemical reactions and is moreover characteristically virulent on injection into certain of the lower animals, then, no matter whether the culture be taken from the nose, throat, vagina, or elsewhere, we have to deal with a case of diphtheria.

Luckily, the diphtheria bacillus, when growing on mucous surfaces, does, as a rule, produce marked symptoms which cause the case to be recognised, but this does not by any means hold good in the case of the nose, though I believe,

in the mildest cases of nasal diphtheria some very slight symptoms are present, and these are probably more noticed in hospital where cases are under continuous observation.

Diphtheria has been long looked upon as a purely throat affection, and it is only during the last few years that the nose has been anything like systematically examined. There can be no better proof of the usefulness of bacteriology taken along with practical and clinical experience than in the case of nasal diphtheria.

Bacteriologists recognise that the nose is as dangerous and requires as much investigation as the throat, but it is doubtful if the practitioner fully realises this fact.

Virulent material may be harboured in a cavity such as the nose without producing obvious symptoms in the patient; yet it is capable of producing a serious or, may be, fatal attack when transmitted to another person. This is all important, and herein lies the danger of the "carrier" in diphtheria.

The nasal cavity both from the functional and anatomical points of view is admirably suited for the inception and reception of micro-organisms, so that there would seem to be nothing remarkable in finding the diphtheria bacillus so often there.

The accessory sinuses of the nose have also been

found to contain the diphtheria bacillus.

To this type of patient the term "carrier" or "positive contact" is applied: i.e. in the case of Diphtheria those who harbour the Diphtheria Bacillus without showing clinical signs.

In the series of cases which I have investigated, the places usually examined were the throat and nose and, if there was otorrhoea, the ear-discharge also.

The endemicity of Diphtheria in certain districts and among convalescent scarlet fever patients is partly if not wholly to be accounted for by the fact that the carrying-capacity of the nose as a vehicle of infection has been greatly overlooked: there is as much need for the thorough bacteriological examination of the nose as of the throat.

The subject of Post-Scarlatinal Diphtheria may be discussed under the headings, (1) Varieties (2) Aetiology (3) Bacteriology (4) Symptoms (5) Clinical Experience (6) Prevention and (7) Treatment.

1. Varieties: (a) The commonest type of post-scarlatinal diphtheria is that in which there is a chronic and persistent rhinorrhoea commencing as a rule during the convalescent stage of an attack of scarlet fever. So far as I can judge this variety includes the great majority of the cases of nasal diphtheria. Out of 70 cases of post-scarlatinal diphtheria which have occurred in Monsall Hospital since

January of the present year, 47 cases had either a profuse yellowish muco-purulent secretion or a secretion more sanious in character. There was no membrane present, but the nostrils were filled with this yellowish secretion and yellow-brown crusts, and from the more or less constancy and persistence of this ^{secretion} there was, as a rule, well-marked excoriation of the upper lip.

In most of the cases there was also some slight degree of epistaxis, but this was never at any time profuse in any of the cases.

- (b) The second class I would define as that containing those cases which show little or no clinical evidence of diphtheria, and on this type of case depends, I have little doubt, those recurring outbreaks of diphtheria in scarlet fever wards and also the endemicity of the disease in all our large towns.

The necessity of isolating this apparently-well patient or "carrier" is one of the problems confronting our Public Health Authorities to-day. These "carriers" have been sub-divided into four groups:

- (a) Those which show no clinical evidence of diphtheria in whom the bacillus is found for a short time only.
- (b) Those where there is a previous history of sore throat or recurring colds - which was probably a neglected case of diphtheria.

(c) Those where the diphtheria bacillus is found in throat, nose, or ear with some slight local lesion.

(d) This group comprises the chronic "carrier" who has had a definite attack of diphtheria, but where the diphtheria bacillus has remained for a long time after the disappearance of the clinical symptoms.

A case has been reported to me where the diphtheria bacillus was found in the nose nine months after the attack of diphtheria.

Another case, which 8 years previously had been treated for ^ufancial diphtheria returned at the end of that time with laryngeal diphtheria and in the interval had suffered from frequent attacks of what was taken to be nasal catarrh and tonsillitis.

ETIOLOGY: Most of the cases occur in ^{children} (those) of school-going age - from 3 - 15 years. Sex has apparently little or no influence. The curve of seasonal incidence in post-scarlatinal diphtheria, as in diphtheria generally, shows a definite relation to the cold months of the year - the maximum mortality being reached in November and December and the minimum in the Summer months.

Records of epidemic prevalence show the same preference for the cold months, and many are associated with cold and wet weather. It has been observed that there is a greater average prevalence upon damp soils.

Open air life and recreation out of doors tend to

lessen the incidence of infectious disease. During the short dull days of the Winter months indoor-life with closed doors and windows comes naturally to the people, and as a result we have the occurrence of infectious disease with the onset of Winter. The same result has been observed in the Summer months when the season has been cold and wet and less out-of-door life obtainable.

In looking at the zymotic history of any large town this is the only effect traceable to seasons and meteorological conditions in general, viz., the increased opportunity for the spread of disease by increased personal contact. As diphtheria is endemic in all our large towns, so post-scarlatinal diphtheria may be said to be endemic in all our large fever hospitals, and the transition from endemicity to epidemicity in both cases, is a matter of volume, and the increase in volume that determines the epidemicity is to be attributed almost wholly to the "carrier".

The idea that defective drains and foul odours may give rise to an attack of diphtheria has long been cherished by the public, and to some extent by members of the medical profession, but when one sees in an epidemic of diphtheria that the newer and more sanitary parts of a city provide more cases than the slums, one fails to detect any direct causal relationship.

Further, post-scarlatinal diphtheria occurs and

will occur in wards which are well ventilated and thoroughly sanitary, unless the cause is looked for in the patients themselves. In other words the disease is a personal one and personally propagated, and, at the utmost, sanitary defects and unhealthy surroundings can act merely as predisposing causes in lowering the general condition of the patients. It follows also that overcrowding in wards may be an indirect cause, and as the disease is personally propagated, the more patients, the more ^{greater} chances there are of the disease being introduced and of spreading.

The introduction to scarlet wards of patients suffering from diphtheria should not occur, as the diagnosis of doubtful cases can be cleared up by the aid of bacteriology and temporary isolation.

The number of cases in which patients are actually suffering from scarlet fever and clinical diphtheria on admission to hospital, is, so far as I am aware, very low, although it is stated that 1046 cases of the combined disease were admitted into the London Fever Hospitals in the four years 1896 - 1899, giving a percentage of about 2.

But I have no doubt that the principal cause of post scarlatinal diphtheria is the introduction into the scarlet fever wards of patients harbouring the diphtheria bacillus in the nose or throat, or both, but with no clinical symptoms of the disease. Scarlet fever patients are

extremely likely to be harbouring the Diphtheria bacillus especially when outbreaks of the two diseases are running concurrently, and the danger is at its maximum, not when the diphtheria cases are well-marked and the fatality rate high, but when the epidemic is declining and there is a high percentage of "carriers" found.

Diphtheria has for so long a time been looked upon as a throat disease with well-marked signs and symptoms, and often with a fatal termination, that an ambulant variety of the disease has not, at any rate, until recent times, been sufficiently recognised.

Different observers have found these epiphytic bacilli at times pathogenic, at other times apparently innocuous, but I am convinced that the latter evidence is of little value, for an attack of scarlet fever seems to so prepare the pharyngeal and laryngeal mucous membranes, that there is every likelihood of the bacilli assuming virulence later when planted on a suitable soil.

In other words, all scarlet fever patients who have bacilli morphologically corresponding to the Diphtheria Bacillus on admission should be isolated, and I believe this to be the keynote in the prevention of post-scarlatinal diphtheria. Nursing scarlet fever and diphtheria on the same site may, I think, be dismissed as a causative agent, for with anything like isolation precautions it is hard to see that there is much danger in this factor. Further,

the conversion of the pseudo-diphtheria or Klebs-Löffler bacillus into the Klebs-Löffler bacillus and vice versa.

Post-Scarlatinal Diphtheria is just as common in hospitals which nurse only scarlet fever patients as in those which receive both diseases; another interesting point ^{being} (is) that it is common in hospitals which receive only convalescent scarlet fever patients.

Another possible cause is infection by members of the hospital staff, through the transference of nurses from Diphtheria wards to Scarlet Fever wards, or through nurses suffering from an unreported or unrecognised mild attack of diphtheria. One instance has been reported in which a nurse suffering from mild pharyngeal diphtheria infected sixteen scarlet fever convalescents.

BACTERIOLOGY: There have been some attempts at classification of the diphtheria and diphtheroid bacilli. Cobbett classified them thus:-

(1) Diphtheria bacilli, virulent, acid formers, (2) Non-virulent diphtheria acid-formers, (3) Pseudo-diphtheria bacilli, non acid formers.

This system is quite good when one has the opportunity of testing virulence on the lower animals by inoculation, but this however is not always practicable.

Unless one is also to test cultures by inoculation this classification is useless, since acid-forming bacilli may be either virulent or non-virulent; again some competent observers have advanced evidence that there may occur the conversion of the pseudo-diphtheria or Hofmann's bacillus into the Klebs-Löffler bacillus and vice versa.

Hewlett and Miss Knight came to the conclusion that in some cases at least the Hofmann bacillus is a modified Klebs-Löffler bacillus, but one far removed from virulence, and they deem it wise to treat anginal cases in which the pseudo-diphtheria bacillus is found as possibly infective. Such competent observers as Park and Beebe, Cobbett and Clark are of opinion that the Hofmann bacillus has probably nothing to do with diphtheria. It follows, therefore, that one must rely chiefly, for ordinary purposes, on the morphological appearances under the microscope.

Since January of this year there have been 70 cases of post-scarlatinal diphtheria occurring in the wards of Monsall Hospital. (These cases ^{all} had either in the throat, nose, or ear bacilli morphologically corresponding to the Klebs-Löffler bacillus, and if further proof was required these cases gave rise to true clinical attacks of diphtheria in the different wards affected - numbers 3, 9, 10, and 11. - In each of the three wards 3, 10 and 11, there occurred a typical ^ufacial attack, and in Ward 9 a laryngeal case occurred of such severity as to necessitate tracheotomy. All the cases made good recoveries.

Westbrook places all the different forms of diphtheria bacilli in three groups distinguished by their staining reactions with methylene blue. Those with deeply

stained granules he classifies as "granular forms", those with transverse bands "barred forms", and those staining evenly "solid forms". There seems to be no doubt that the prevailing type of bacillus varies in different epidemics. It has been stated that it is the solid form which is found chiefly, in varying proportions, in the throats and noses of apparently healthy people.

Gorham and Westbrook think that the virulence of the bacillus is correlated with its microscopic form, and that the change from the granular and barred types to the solid takes place under the influence of the body fluids.

The culture medium used here is Löffler's blood serum and the films are stained by Neisser's method. In most colonies a variety of forms of the diphtheria bacillus is found, but as a rule one form predominates.

A series of throats or noses from one family taken at the same time may give the same variety of form of the bacillus; while again different forms may predominate in colonies from a series of throats taken together and evidently due to the same infection.

No special variety of form was observed to coincide with special benignity or malignity clinically.

It is remarkable for what long periods the diphtheria bacillus may remain in the nose in spite of energetic treatment.

Le Geure and Pochon report a case in which they obtained positive cultures from the nose for fifteen months.

It is quite possible that the infectious condition of the nose may be kept up by the disease spreading to the accessory sinuses, especially to the antrum.

Wolff reports that out of twenty two cases of diphtheria he found the bacillus in the antra in twelve of these.

Councilman, Mallory, and Pearce have also found the diphtheria bacillus, either in pure growth or along with other organisms, in the antra in twenty-one out of the fifty-two fatal cases.

In the nose the bacillus was found to be associated with staphylococci, and, as the bacilli disappeared, only a pure culture of staphylococci remained; but, in some cases, the bacillus Hofmanni remained.

Angus Macdonald, presuming on the possibility of antagonism in growth to account for the predominance^a at one time, and the disappearance at another, of the diphtheria bacillus, attempted, by swabbing with other organisms, the throats and noses of protracted cases, to kill off the diphtheria bacillus.

Swabbings were made with (1) Fusiform bacilli, (2) Staphylococci and (3) Moulds; but it was found that the diphtheria bacillus persisted.

Whether phagocytosis or the antagonism of other organisms in the mucosa is the cause of the disappearance of the diphtheria bacillus, there seems to be no direct evidence.

It is difficult to decide what ought to be done in cases where the Hofmann bacillus persists in the nose.

In the present state of our knowledge it is probably safer to adopt local treatment and some form of isolation in the case of all persons - especially when diphtheria is prevalent in an institution or district - in whose nose or throat this organism is found.

But as in the series of cases which occurred in this hospital, when cases of ^ufacial and laryngeal diphtheria occurred in wards of convalescent scarlet fever patients, one can have little doubt of the virulence of the organisms found in the noses and throats of many of these cases.

SYMPTOMS: The remarkable fact about most of the cases that occurred here was the absence of any severe symptoms considering the virulence of the organisms which they were harbouring.

The classical symptoms were present in only a small proportion of the cases. These were - slight epistaxis with profuse muco-purulent discharge from the ^{nose}~~throat~~; nasal obstruction causing marked oral breathing; and severe excoriation of the upper lip resulting from

the irritating discharge; ^{the} temperature as a rule only slightly increased.

In other cases the symptoms were those of nasal catarrh and obstruction with no marked constitutional disturbance.

Many of the cases had rhinorrhoea more or less persistent: the discharge was thick and muco purulent, and the nasal mucous membrane was congested and thickened.

Some of the cases had only the very slightest sanious discharge ^{with} and some reddening of the nasal mucosa, and I have little doubt that it is this type of case which, though apparently well, constitutes the greatest danger to the community.

CLINICAL EXPERIENCE: There have been many outbreaks of diphtheria reported which have been caused by an unrecognised case of nasal diphtheria.

Park records a case, in a child with only a slight nasal discharge, in which diphtheria bacilli were present, which gave rise to diphtheria in four children, two of whom died.

Cobbett traced the outbreak of diphtheria at Cambridge and Chesterton in 1900 to a case of nasal diphtheria.

Heaven in a paper read before the Incorporated Society of Medical Officers of Health cites some very remarkable cases in which nasal diphtheria was the only known source of infection in certain school outbreaks.

He found that a case of obstinate nasal discharge preceded two cases of true ^ufancial diphtheria. ^{3 in nose and}

At another time he found ^{that} four children and two nurses in a public institution sickened sequentially: examination of the throat and nose of each remaining inmate of the ward was made, and while all the throats were found clear, the noses of two children suffering from a nasal discharge of apparently no significance were found to contain free growth of the diphtheria bacillus: isolation of these children was followed by cessation of the recurring outbreaks in the ward. ^{of diphtheria through the agency}

One cannot but be struck by the frequency with which the nasal cavity has been found harbouring the diphtheria bacillus. As nearly all these nasal cases are "carriers", one should naturally expect that an appreciable proportion of the scarlet fever admissions to any fever hospital would also show the presence of the diphtheria bacillus in their noses.

In order to gain information as to the number of scarlet fever patients admitted to hospital harbouring the diphtheria bacillus, nose and throat swabs have been taken at Monsall Hospital of all the scarlet fever admissions since the 14th February of this year. From that date till 4th May there were 228 scarlet admissions and of these twelve were found to be harbouring the diphtheria bacillus in their noses; this gives a percentage of 5.2. At

another Institution where 297 scarlet cases were examined, 17 had the diphtheria bacillus in the nose, 3 in nose and throat, and 4 in the throat ^{only}.

Scarlatinal convalescents are extremely liable to develop rhinorrhoea during the fourth, fifth, or sixth week of their illness, and as this is also the period during which post-scarlatinal diphtheria appears, and seeing that the nose so frequently acts as a nidus, there seems little reason to doubt that there is a direct causal relationship between the two.

The introduction of diphtheria through the agency of the throat is not to be feared nearly so much, for a clinical or suspicious attack is detected on admission, and any case of sore throat during convalescence is always complained of and can be investigated. Further the throat in scarlet fever patients receives more routine antiseptic treatment and is consequently not so liable to be a source of infection.

It is quite a different question in the case of the nose, for patients can be admitted harbouring the bacillus in a quiescent condition, and they display no symptoms until the convalescent scarlatinal rhinorrhoea gives it, figuratively speaking, a fresh lease of life. Such cases, unless detected and the patients isolated, spread the disease in the many ways which convalescence renders possible. Nearly all scarlet fever patients are in bed for the first three

weeks at least of their illness and this isolation appears to be sufficient to prevent the transference of infective material. It is when children come into more or less intimate contact with each other, as they do during convalescence from scarlet fever, that these "carrier" cases are able to produce their maximum effect.

The thorough bacteriological investigation of every scarlet fever admission to the hospital wards would, in my opinion, stamp out this serious complication. Those cases which do occur should all have a prophylactic dose of anti-diphtheritic serum of not less than 1,000 units.

PREVENTION: The prevention of this disease in our fever hospitals depends on the thorough bacteriological examination of the throats and noses of all scarlet fever admissions and of the thorough isolation of those that are found to harbour the diphtheria bacillus.

The elimination of the "carrier" case from the community would go far in the way of stamping out diphtheria, and for this purpose encouragement should be given by the Local Authorities for the taking of swabs from the throats and noses of all doubtful cases; and if a case of diphtheria has occurred, a systematic search should be made amongst all the possible contacts, and those isolated who are found to harbour the diphtheria bacillus, whether suffering clinically from the disease or not.

All contacts of school age in a house where a case of diphtheria has occurred should have swabs of the throat and nose taken.

Of 180 such cases examined at Reigate, 25 were found to harbour the diphtheria bacillus. In Cambridge and Colchester special Sanatoriums are provided for these cases: this is a most desirable condition of affairs. The "carriers" taken there have proved to be very chronic cases, and as a rule they outstay their relations who went to hospital on account of definite attacks of diphtheria.

In a School outbreak in Surrey not long ago eight clinical cases were found as against 21 carriers, and 16 of these were of the nasal type. This epidemic illustrates the great prevalence of the nasal type of the disease. The infection in this case had been gradually spreading through the school for two months before a clinical case occurred.

Such a large proportion of "carrier" cases indicates the almost hopelessness of abolishing diphtheria epidemics so long as there are large centres of population where the disease is endemic. It has been thought by some that if bacteriological examinations were made of the throats and noses of all the patients in the children's wards of many of our large hospitals, a surprising number of "carriers" would be found.

The nasal "carrier" is undoubtedly the most important epidemiologically.

It is along such lines as are above indicated, viz., isolation of the diphtheria "carrier" and widespread bacteriological examination of all "contacts" and suspicious looking throats and noses in children of school-going age, that we can hope to lessen the incidence of this disease, and perhaps ultimately to eradicate it from our midst.

TREATMENT: The treatment of the cases that occurred here was on simple lines. It consisted of (a) Local and (b) General treatment.

LOCAL: This was carried out by keeping the nose as clean as possible by means of frequent swabbing and also by the use of an alkaline spray. The oftener this is done the better. Insufflations of Boric and Iodoform powders between the sprayings seemed also to prove helpful.

GENERAL: This consisted in administering 2,000 units of anti-diphtheritic serum in all the cases where diphtheria bacilli were found.

(6) With plenty of fresh air and good food all the patients made excellent recoveries.

(7) All cases of rhinorrhea, otorrhea, and sore throat occurring during convalescence from scarlet fever should be thoroughly investigated bacteriologically.

(8) When "positive" cases are found these should be strictly isolated and given a prophylactic dose of anti-diphtheritic serum.

CONCLUSIONS:

- (1) There should be wide bacteriological examination of all "contacts" when a case of diphtheria has occurred.
- (2) Public Health Authorities should encourage the taking of swabs in all cases of sore throat or persistent rhinorrhoea, and from the nose and throat of any scarlet fever patient who may suggest the presence of a double infection.
- (3) The habits of children readily account for the spread of infection: outside we have cases of diphtheria arising; and in our convalescent scarlet fever wards we get post-scarlatinal diphtheria.
- (4) Direct contact is the primary factor in the spread of diphtheria.
- (5) As regards social status, this is only a consideration so far as it increases or diminishes "carrier" opportunity.
- (6) The elimination of the "carrier" would stamp out epidemics.
- (7) All scarlet fever admissions to fever hospitals should have throats and noses bacteriologically examined.
- (8) All cases of rhinorrhoea, otorrhoea, and sore throat occurring during convalescence from scarlet fever should be thoroughly investigated bacteriologically.
- (9) When "positive" cases are found these should be strictly isolated and given a prophylactic dose of anti-diphtheritic serum.

BIBLIOGRAPHY:

1. Abbott: The Aetiology of Membranous Rhinitis.
2. Cobbett: Observations on the recurrence of diphtheria at Cambridge in the Spring of 1901.
3. Councilman, Mallory and Pearce: A study of the Bacteriology and Pathology of 220 fatal cases.
4. Eade: Notes on Diphtheria.
5. Farlow: Chronic catarrhal processes following Scarlet Fever.
6. Gerham: Morphological Varieties of the Diphtheria Bacillus.
7. Hewlett & Knight: Manual of Bacteriology.
8. Jenner: Diphtheria; its history, progress, etc.
9. Mackenzie Sir M: Diphtheria: its nature and treatment.
10. Macdonald Angus G: A study in Epidemiology.