

STUDIES ON THE BACTERIOLOGY OF
HYPOPYON ULCERIII.—A Bacteriological Investigation
of 120 Cases of Hypopyon Ulcer

BY

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Introduction

A SPECIAL investigation into hypopyon ulcer is being conducted in Scotland under the auspices of the W. H. Ross Foundation for the Study of Prevention of Blindness. Certain preliminary observations, on the conjunctival flora of mine workers, who constitute a high percentage of the admissions to hospital for this condition, have already been published (Rhodes, 1938, 1939 *a*, *b*). At present, certain members of the Clinical Staff of the Eye Department, Royal Infirmary of Edinburgh, are engaged in investigating established cases of hypopyon ulcer, or ulcer of hypopyon type. Bacteriological examination of these cases is also being carried out, and in this paper I will present briefly my results in the first 120 cases, 67 per cent. of which occurred in mine workers. It should be understood that this paper is preliminary, and that full ophthalmological details of this series of cases will be published later by the Ross Foundation.

Methods

Material to be cultured is taken, with a small wire loop or metal spud, from under the edge of the corneal ulcer. If the ulcer is small and the edge indefinite, the surface is touched with the loop; in such cases cocaine may sometimes have to be instilled, but this can usually be avoided. Inoculation is carried out on to blood agar medium, in a special screw-topped vial. After suitable incubation, investigation of the resultant bacterial growths follows the usual lines, and in the case of *Pneumococcus* this examination includes typing by mouse injection. At first, typing tests were only carried out to differentiate between Types 1, 2, 3 and Group 4. Recently, however, certain Group 4 strains have been accurately placed in their correct Type by further tests.

* Working under the auspices of the W. H. Ross Foundation for the Study of Prevention of Blindness, Edinburgh.

Results

The results of the cultural examinations are given in the following table.

Bacteriological Findings in 120 Cases of Hypopyon Ulcer

Result of cultures from edge of ulcer	Number of cases	Percentage of total
No growth on culture - - - - -	26	21.6
Diphtheroid bacilli - - - - -	39	32.4
<i>Staphylococcus albus</i> - - - - -	15	12.5
* <i>Pneumococcus</i> - - - - -	14	11.6
<i>Staphylococcus albus</i> and diphtheroids - -	9	7.5
<i>Staphylococcus aureus</i> - - - - -	4	3.3
<i>Diplobacillus of Morax</i> - - - - -	4	3.3
Anthracoïd (sporing aerobic) bacilli - -	4	3.3
<i>Streptococcus viridans</i> - - - - -	3	2.5
<i>Streptococcus haemolyticus</i> - - - - -	1	0.8
<i>Staphylococcus albus</i> and anthracoid bacilli -	1	0.8

* Nine of the 14 strains belonged to Group 4, and it was further found that two of these belonged to Type 29, and one to Type 28. The remaining five strains proved avirulent to mice, and so could not be typed.

Discussion

A noticeable feature of the investigation is the comparatively high percentage of cases (21.6 per cent.) in which culture yielded no growth, and it would appear that there are at least four possible explanations for this: (a) the specimen may have been improperly taken, and inadequate material obtained to inoculate the cultures satisfactorily; (b) the particle striking the patient's cornea may have itself set up ulceration and hypopyon, without the necessity for the presence of an accompanying bacterial infecting agent; (c) a non-cultivable agent, such as the herpes virus, may have been responsible; (d) it is thought that certain corneal ulcerations may be of an allergic nature (see, *e.g.*, Duke-Elder, 1938).

I do not think that technical reasons were primarily to blame for these negative cultures, for such results were obtained from quite large ulcers, where adequate specimens could be readily obtained. With regard to the rôle of the traumatising particle, an interesting observation was made: namely, only one sterile result was obtained in 21 cases of injury due to stone (*i.e.*, 4.8 per cent.), whereas in 50 cases of injury due to coal, there were 14 negative cultures (*i.e.* 28 per cent.). The precise explanation

of this difference is, however, at present uncertain. With regard to herpes virus, it is known that this may be present in the conjunctival sac and give rise to infection of corneal injuries, with the production of dendritic and other types of ulcer. It is possible that it may have been responsible for certain of these cases, although this is, of course, pure speculation.

In all probability, the correct explanation of negative cultures in hypopyon ulcer varies from case to case.

The organisms most commonly isolated from these cases were diphtheroid bacilli and *staphylococcus albus*, either alone, or in combination. It must be borne in mind that the isolation of these organisms from the ulcer may have been due to a purely accidental contamination from the conjunctival sac, where they are known to occur as commensals in a high percentage of normal persons. In other cases, however, it is probable that they played a definite pathogenic rôle, perhaps aided by some special susceptibility of the corneal tissue to infection.

Hypopyon ulcer is frequently spoken of as the " pneumococcal ulcer," and certain workers have found these organisms in 60-70 per cent. of cases (see Duke-Elder, 1938). In this series of cases, however, pneumococci occupy a relatively unimportant place (11.6 per cent.).

Other pathogenic organisms which were occasionally isolated were *Streptococcus viridans*, *Streptococcus haemolyticus*, *Diplobacillus of Morax*, *Staphylococcus aureus*, and anthracoid bacilli. There is little doubt that pneumococci and these other pathogens should be considered as the primary infective agents in the cases where they were isolated.

My observations show that, rather than being a condition of almost specific (*i.e.*, pneumococcal) aetiology, hypopyon ulcer may be associated with a wide variety of organisms. Further, with the exception of *streptococcus haemolyticus* and *staphylococcus aureus*, all the organisms isolated in this series are those that I have previously demonstrated (1939 *a, b*) in normal conjunctival sacs. There would not appear to be any valid reason why these two organisms also should not occur in healthy sacs.

It may be said that my investigation tends to lessen the emphasis to be placed on the purely infective element in hypopyon ulcer, for it would appear that although in certain cases recognised pathogenic organisms may be responsible, in others organisms usually regarded as commensals may be isolated. In the latter cases it is probable that the influence of the traumatising particle itself, or the powers of resistance to infection of the corneal tissue, are more essential factors in the causation of the ulcer than the presence of bacteria.

In the pathogenesis of any one case of hypopyon ulcer, therefore, three variable factors must be considered: (*a*) the bacterial

flora of the conjunctival sac of the traumatised eye; (b) the nature of the traumatising particle; and (c) the resistance of the corneal tissue to infection.

Summary

The bacteriological findings in 120 cases of hypopyon ulcer are presented and discussed. In contrast with previous workers, pneumococci have been isolated much less frequently. It appears that a wide variety of bacteria may be found in cases of hypopyon, while on occasions the infective element is probably lacking or altogether of minor importance.

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INFANTILE DACRYOCYSTITIS TREATED BY SURGICAL DIATHERMY

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DURING the past few years, several cases of intractable dacryocystitis in infants have come under my observation and care. In each case, a history could be obtained of neglected epiphora at birth, followed by one or more attacks of acute dacryocystitis, with abscess formation and the development of a lacrymal fistula. All the infants concerned were undersized and undernourished, and no radical operation could be attempted until they had been hospitalised for several weeks and their general condition sufficiently improved to warrant a general anaesthetic being administered.