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THE CLINICAL VALUE OF BACTERIOLOGY.¹

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WE must admit that it is now beyond dispute that at least the majority of acute inflammations of the conjunctiva are the direct results of micro-organic life. About twenty years ago, when I was on the staff of the Glasgow Eye Infirmary at Charlotte Street, I remember very well certain patients attending the dispensary who all came from the same tenement in the High Street, and who were all afflicted with acute catarrh. On making investigation, I found that a large number of persons in that tenement were similarly affected. I now know what I did not then, that I was dealing with an epidemic of conjunctivitis due to Weeks' bacillus. It seemed to me at the time that we were dealing with a condition in the eye very analogous to one of the specific fevers in the body. Even at that time the gonococcus was recognised as the cause of purulent conjunctivitis. Since those days matters have changed completely, and it is now believed that there is probably no case of acute conjunctivitis which is not associated with micro-organic life. If we examine the text-books of that period, we will find cases such as I have described as epidemic generally attributed to cold, to draughts, to badly ventilated rooms, sometimes even as the result of exposure to excessive heat.

The micro-organisms of the conjunctiva may be roughly divided into two groups, namely, first, those which are frequently found on the membrane, but only under special circumstances cause inflammation. The chief members of this group are—*Pneumococcus*, *Staphylococcus aureus*, *Staphylococcus albus*, and *Streptococcus*. Secondly, those which, so far as I am aware, always cause an inflammatory attack, although in some cases not at all acute. To this class belong the gonococcus, the diplo-bacillus of Morax, Weeks' bacillus, the Klebs-Löffler bacillus, the diplo-bacillus of Petit.

Pneumococcus.—This is one which is sometimes found in the healthy conjunctiva, but, on the other hand, is very frequently associated with severe pathological processes. It often gives rise to conjunctivitis. It is very frequently associated with hypopyon, and is very common in dacryocystitis. In the organism the cocci are oval or tapering, generally having the appearance of diplo-cocci, or united into small chains and surrounded by a capsule. They are about 1 micro-millimetre in length. The organisms as

¹ Remarks made at a demonstration to the post-graduate students at Glasgow Eye Infirmary, December 1905.

grown in cultures have no capsule. They are easily coloured by the basic aniline dyes, and retain Gram. The best medium for their cultivation is serum agar. When they give rise to conjunctivitis, the case is, as a rule, tolerably severe. Such conjunctivitis is specially common in newly-born children, and may, when an insufficient examination is made, be mistaken for the specific ophthalmia neonatorum. Many of the cases of membranous conjunctivitis are also associated with this parasite. It may be said without fear of contradiction that the pneumococcus is the most common organism in hypopyon ulcer.

Staphylococcus aureus is, as a rule, very readily recognised by the yellow appearance of the growth in the agar-agar tube. The organisms are not very common, but undoubtedly may give rise to trouble in the conjunctiva. They are sometimes associated with attacks of conjunctivitis of a mild type. The chief importance of their presence in the conjunctiva is that operations as a rule should not be undertaken till they have been removed by suitable treatment.

Staphylococcus albus is very easily recognised from its white lardaceous appearance in the agar-agar tubes. It is all but innocuous. An exception to this rule will be mentioned at a later period of the evening.

Streptococcus, on the other hand, is undoubtedly dangerous. It is doubtful if it is ever present without setting up an acute conjunctivitis. I have myself, however, seen a conjunctiva perfectly quiet at the time, in the secretion from which were found streptococci. The patient gave an account of a previous and recent acute attack of inflammation.

It is frequently associated with some acute condition in the lachrymal passages, but at times seems to have only very feeble virulence. It is interesting to note that not infrequently it is found in cases of dacryocystitis, and that certain of these cases closely resemble genuine attacks of erysipelas. Quite recently I saw a patient who had been certified as having true erysipelas. In this particular individual there was obstruction of the lachrymal passage on one side, and in the secretion there was found streptococcus. The attack of erysipelas had been confined to the same side of his face. It is sometimes difficult to draw the line between genuine erysipelas and acute dacryocystitis. All ophthalmic surgeons who have any large experience in treating lachrymal sac conditions must have observed that the passing of a probe was sometimes followed by acute cellulitis of the parts involved. When I was a student, I saw a case in which the inflammation spread all over the upper part of the face, extending even to the forehead. It seems to me that such an occurrence may be very readily explained, by supposing that the passage of the probe has wounded the tissues, and thereby given rise to an inoculation.

The parasite appears characteristically in the form of small

chains of cocci. It is sometimes found as part of the contents of the leucocytes, and is easily stained with the basic aniline dyes, and retains Gram. It is easily cultivated on agar, and is very frequently found in acute dacryocystitis, although only very rarely in lachrymal mucoceles. Sometimes it is found in pseudo-membranous conjunctivitis.

Of those which are only known to exist in the conjunctiva in connection with an acute inflammatory attack, probably the most frequent is *Weeks' Bacillus*. These parasites grow on agar, but much better on blood serum. They are about 1 micro-millimetre in length, stain easily with methylene-blue, but decolorise with Gram. They tend to become grouped in the protoplasm of the cellular elements. So far as I am aware, the only disease which they produce with regard to the eye is an acute muco-purulent conjunctivitis, which generally is perfectly simple, and does not involve any serious consequences. In about 5 per cent. of the cases there is a slight ulceration, chiefly at the margin of the cornea, but where that takes place there not infrequently is a history of the eye having been bandaged or fomented or poulticed.

The condition is highly contagious, and the infection is generally conveyed by towels, or by persons using the same basin, or by the fingers.

The *Diplo-Bacillus* of Morax produces a form of ophthalmia which is generally mild. There is reason to believe that this parasite has a good deal to do with those cases which are generally classed as blepharitis marginalis. This parasite is of relatively considerable dimensions. It is from 4 to 5 micro-millimetres in length, and 1 in breadth, and has little tendency to become intracellular. It grows well on ascitic agar, but not on ordinary media. The parasite is easily distinguished by a sort of constriction at its centre, to which the name diplo-bacillus is due.

The *Gonococcus* is one of the most important of all eye parasites, because it is one which is very dangerous to sight. It stains easily with methylene-blue, and becomes de-stained by Gram. The parasite is reniform in shape, and is, in general, intracellular. It develops well on serum, but does not grow on other media, such as agar-agar. Sometimes it is a matter of importance to distinguish this micro-organism from another to which the name "pseudo-gonococcus" is given.

The pseudo-gonococcus retains its colour when subjected to Gram, and will grow on the ordinary media, such as agar-agar.

The last micro-organism which I wish to mention is the *Klebs-Löffler Bacillus*, which should always be looked for in all forms of membranous ophthalmia. These parasites are of considerable but of variable size. They are easily stained with the basic aniline dyes, and retain their colour when subjected to Gram. They are best grown on coagulated serum. This, of course, is the parasite associated with diphtheritic ophthalmia, and it is a matter of im-

portance to be able at once to diagnose so very dangerous a malady. It is true that membranous ophthalmia sometimes occurs without this parasite, but when it is found we should always remember that the patient has a grave constitutional as well as a local disease, and in some cases it will not merely be justifiable but necessary to adopt serum injections.

I wish now to say a few words as to the importance of bacteriological investigations in clinical work. To begin with, there is no other method in which we can in the early stages distinguish between the various forms of conjunctivitis. It is a great advance on the older practice of seeing a patient with an inflamed eye; of giving the condition the name of catarrhal ophthalmia, and of prescribing one or other of the lotions and possibly one of the ointments formerly so much in vogue. The late Sir William Aitken, in advocating in general medicine the necessity of making frequent post-mortem examinations, said that the physician who neglected such work might see many cases but saw few diseases. The more recent developments of pathological biology have given us a method of easy diagnosis which is of great value, although yet in its infancy. The oil immersion lens is to my mind just as necessary a part of the apparatus for diagnosis in an ophthalmic clinic as is the ophthalmoscope. There is no doubt that the best results can only be obtained by a thoroughly trained and expert pathologist, which I do not pretend to be; but even surgeons who are not in this sense experts can obtain information which is to themselves and to their patients of the very first importance. Supposing a patient appears at the clinic with a catarrh, how else are you to determine in its early stages whether it is a simple catarrh produced by Weeks' bacillus or one of the graver and more serious forms, such as that due to the gonococcus or the Klebs-Löffler bacillus? I know of no other method; yet such an early diagnosis is simply vital in the treatment of the case for should you get the gonococcus it will be your duty at once to warn the patient and his friends of the contagious nature of the disease, and of the dangers which may arise to the other eye of the individual or to other persons from contact. If you have undoubted evidence of the presence of the gonococcus in one eye, it is your duty to seal up the other so that no contagion is possible. Given the presence of the Klebs-Löffler bacillus, it would be your duty to watch the patient constitutionally very carefully, and in some cases it might even be necessary to inject the anti-diphtheritic serum. Personally, I do not remember to have ever seen a case of this kind; they are somewhat rare in Great Britain, but are frequent enough in some other parts of the world.

It is also of importance that, if possible, every eye which is to be operated upon should be examined bacteriologically before it is touched, and in all cases, except where there is urgency, no operation should be undertaken till the surgeon has satisfied himself that no

pathogenic micro-organisms are present. I have not seen a suppuration after an operation involving the opening of the eyeball for a very considerable time. With one exception, to be noted presently, if, on bacteriological examination, evidence of the presence of bacteria is not found, then the case will give you no trouble. As a rule, the conjunctiva will remain almost normally white.

The one exception to be noted is that often tolerably acute inflammation follows operation where the patient is rheumatic or gouty, and I always approach such cases with some trepidation.

Where you get the *Staphylococcus albus*, unless it be very abundant, you may operate with safety, but generally in such cases there is a good deal of external catarrhal disturbance after the operation, although I have never yet seen an eye lost from the presence of this parasite. Of course no amount of care will prevent the occurrence of intraocular hæmorrhage and the escape of vitreous. They will probably give trouble alike to patients and surgeons till the end of time.

Lastly, what new views as to treatment do we obtain from the modern theory as to the infectivity of conjunctivitis, and even of blepharitis, for of late many cases of this disease have been shown to be due to the diplo-bacillus of Morax? All treatment must be viewed under two aspects, the prophylactic and the curative. In general medicine, prophylaxis has made enormous strides, with the result that several of the specific fevers are now almost never seen; even tuberculosis has decreased very much since the malady was definitely recognised as infectious. In the prophylaxis of a patient who has an inflammation of the conjunctiva, two points must be attended to—(a) If only one eye is affected, then care should be taken that the other eye is not involved; (b) those in attendance on the patient must be warned of their danger.

As regards actual treatment, little if any progress has been made. No doubt many of the older remedies which were so much in vogue in the year 1879, when I entered the Glasgow Eye Infirmary as a student, have fallen into disuse, and new ones have taken their place. The question is, are these new preparations of greater utility than those which they have supplanted? I think not. The whole attitude of mind of a certain French school which is sometimes copied in this country reminds me forcibly of the history of a series of patents to diminish the consumption of coal in steamers. The first improvement was to save some 50 per cent. of the fuel. This was immediately followed by another to save another 25 per cent. Four or five years later an enterprising engineer made an improvement to save an additional 30, and so on till the steamer at last must have been making coal at a very considerable rate. It seems to me that there is something analogous to this in so-called modern ophthalmic therapeutics.

A few years ago somebody invented protargol, which is, as every-

body knows, an organic preparation of silver. It was announced as being marvellously efficacious, infinitely better than nitrate of silver, and the surgeon could use it without producing argyrosis. Protargol was said to have greater penetrating powers than nitrate of silver, and was altogether to revolutionise ocular therapeutics. A few months dispelled a part of this statement, for the salt was found to produce argyrosis quite as markedly as silver nitrate; and I think its great potency in curing disease may well be doubted when we consider that a few months later it was found necessary to invent another drug, known by the name of argyrol. Again there was the usual excitement, and great healing virtues were claimed for the new remedy.

Still more recently, other drugs of a like nature have been announced as possessing most wonderful properties. The whole thing is to my mind rather suggestive of some firms of manufacturing chemists who have certain articles to put on the market; their success depends on the fact that most persons are richer in faith than in the critical faculty. At any rate I have not found any of these drugs at all to coincide in value with their vaunted efficacy. Moreover, Mr. Bishop Harman, who has looked into this question tolerably thoroughly, has nothing to say in their favour. So far as proofs are available, they entirely confirm the views which we have expressed, and, in concluding, I would like to call attention to four distinct lines of argument.

1. Most cases of conjunctivitis heal of their own accord, just as do the specific fevers. In days gone by it was the practice of some physicians to administer small doses of belladonna to patients who were afflicted with scarlatina. No doubt a due proportion of such patients recovered. Would any one at present attribute their recovery to the infinitesimal doses of belladonna which had been administered?

So I should hesitate, when an infectious conjunctivitis recovers, to attribute the issue to any drug used. Such cases as, say, the conjunctivitis of Morax or of Weeks, will recover after they have run their course if simply left alone and kept clean. Take a case of Weeks' conjunctivitis: you put into the conjunctival sac a few drops of a solution of protargol, and the patient gets better. I hold that you are not entitled to regard this as cause and effect, unless, indeed, you are prepared, when a patient who has a Weeks' conjunctivitis and is under one of these new remedies is found on a subsequent visit to the hospital to have developed a corneal ulcer, to attribute this ulceration to the remedy employed. If you attribute recoveries to the use of these drugs, I fear, as a matter of logic, I must insist upon your attributing also the untoward events, which will take place in a certain proportion of cases, to the same remedy. One of the most extraordinary statements I have ever read is that solutions of protargol are much better than nitrate of silver, because the weaker the solution the

more potent the drug. For example, a $\frac{1}{2}$ per cent. solution is more powerful than a 2 per cent. solution.

To my mind it is a curious idea that, used in proper doses, the efficacy of a remedy is inversely as its strength.

2. In our agar-agar tubes with cultivations upon them we have a means of investigating this subject. Again and again the colonies growing in these tubes have been for considerable periods immersed in a 15 per cent. solution of protargol, and certainly for the most part without making the slightest difference to them. Mr. Harman points out, and probably truly, that as protargol is a colloid, and not a crystalloid, its powers of penetration must be extremely limited.

3. My own clinical experience has by no means given me the favourable results which other men speak of. I have already summarised this aspect of the question in an article which appeared in the *British Medical Journal*, and to which I may refer. Since writing that article, a very striking case has come under my notice. It was that of a gentleman with senile cataract, who had a constantly inflamed conjunctiva on the same side as the eye on which I proposed to operate. I delayed the matter for a month, and sent him to his doctor in the country, who forthwith began to apply protargol regularly and systematically. By the end of the month the conjunctiva had become considerably more inflamed, and the parasite which was the cause of the conjunctivitis was a great deal more abundant than it had been a month previous. No improvement had been effected at all by the protargol. What really put that man right was to give up all so-called astringent remedies and to irrigate his conjunctiva thoroughly three or four times daily with a large quantity of tepid normal saline. This has been my invariable experience. The only way in which you can get a chronically inflamed conjunctiva clean is by brushing or rubbing and thorough irrigation. Some years ago I had an opportunity in one of the public hospitals of making an experiment on a large scale. The medical officer in charge was much troubled every now and again by an outbreak of contagious ophthalmia in the wards set apart for children. He asked me to pay some visits to the institution so as to see the cases with him. One-half of the children so afflicted were treated simply by irrigation, the others by irrigation and the so-called astringents, and, just as I had expected, the one set did quite as well as the other.

4. Not infrequently I have found that protargol and argyrol gave disappointing results in the hands of other surgeons. I have mentioned Mr. Bishop Harman; and more recently a medical man, who has had considerable experience of measles wards, tells me that he has found no perceptible benefit from the use of these drugs in the conjunctivitis which accompanies measles. But, further, within the last year I have seen a good number of cases

in connection with the Workmen's Compensation Act, and in a considerable proportion of these one of the eyes had, in consequence of injury, been removed. Not infrequently the socket from which the eye has been removed falls into a state of chronic suppuration. Often one of the pleas is that the man is not able to resume duty on account of this suppuration, and this condition may be found often five or six months or even years after the injury. It seems to me that if these drugs really had the value which some of their advocates claim for them, the matter should have been put right, or the suppuration checked, within a few days. Some of the gentlemen attending on these very cases are amongst the foremost advocates for the use of protargol or argyrol.

I therefore cannot believe that the drugs have been improperly applied; I have rather come to the conclusion that they have not the efficacy which is claimed for them.

Biological pathology, although still in its infancy, has done a great deal for the practitioner already, and doubtless has much in store. It may give us serums which will in the future save many eyes that at present are lost. But what I maintain just now is that it has already shown us that at present we have no drug which can be used to the conjunctiva in a sufficiently strong solution, or for a period sufficiently prolonged, to be germicidal.

Ophthalmic surgery must at the present moment be aseptic and not antiseptic. Success lies in the mechanical removal of the parasite. Well do I remember the prodigious claims which were made for boracic acid solution as an antiseptic in ophthalmic surgery. I even remember a prescription for a boro-glyceride lotion being solemnly added to the formula book of our own Eye Infirmary. I do not suppose anybody now claims active properties for these remedies. Some authors of undoubted experience tell us quite frankly that they find solutions of protargol and of argyrol more satisfactory than those of nitrate of silver.

I think there are some obvious explanations of this view of the case. To my mind the chief explanation is that these substances are very nearly inert. Nitrate of silver, on the other hand, in almost any strength, will cause destruction of the protecting epithelium of the conjunctiva, and will allow the parasite to get a firmer hold. In other words, they act better than nitrate of silver, because they are not harmful. Moreover, persons who employ protargol generally do it by a process of hard brushing or of wiping or of rubbing. I confess that I think any benefit derived is from the process employed and not from the drug used. It is the mechanical removal of the mischief, not its destruction. The modern biological pathology has done much for us, and its teachings are welcome alike to the surgeon and to the modern therapist. I feel confident that the surest progress is likely to be made by following the study of the natural history of disease.