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TRACHOMA AMONG THE CHINESE IN FRANCE

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IN the early part of 1917 the first drafts of Chinese recruited as voluntary labourers by the British Government began to arrive in France. On reaching the Dépôt of the Chinese Labour Corps each draft of men was subjected to a routine medical inspection which included the examination of the everted lids. It was found that 10 to 15 per cent. of these early drafts were affected with trachoma.

Remembering the disastrous experience of Napoleon's army in Egypt, in 1798, and the widespread dissemination of trachoma among the civilian population of Europe by his soldiers on their return, the Consulting Ophthalmic Surgeon of the B.E.F. in France, Colonel W. T. Lister, C.M.G., A.M.S., realized the grave menace to the health of the white troops and civilian population in France, if these heavily infected companies were allowed to mingle at all freely with them. Moreover, it was evident that unless immediate

steps were taken to separate the men with trachoma from their uninfected companions, there would be a rapid spread of the disease and the whole body of men would be to a great extent handicapped in the performance of the work for which they had been recruited.

Classification

For purposes of segregation and administration the Chinese were divided at the initial examination in France into three classes.

(1) "X"—men with healthy conjunctivae, free from all suspicion of trachoma.

(2) "Z"—cases of manifest trachoma.

(3) "Y"—cases of chronic conjunctivitis, forming the borderland between "X" and "Z"—This group included cases of inflamed and altered conjunctiva in which it was impossible to tell at a single observation whether they were trachoma-free or not.

With regard to the disposal of the men with trachoma, it was obviously inadvisable to repatriate so large a body of men who, apart from their eye disease, were in splendid physical condition. It was decided to form separate "Z" companies, to be composed entirely of men suffering from trachoma. These "Z" companies were sent to special "Ophthalmic treatment centres" at Calais, Boulogne, Etaples, and a few other places, in which they were constantly under supervision and treatment by ophthalmic specialists. Great care was taken to insure that their quarters were entirely separate from those of any other unit.

The men classified "Y" were kept under treatment at the hospital for a week or ten days. A number of them cleared up under treatment and were discharged as clean—"X." Some, as the associated conjunctivitis subsided, showed evidence of trachoma and were accordingly drafted into a "Z" company. Others remained in an indeterminate condition; as limitation of accommodation prevented their being retained longer in hospital, they were formed into "Y" companies. These "Y" companies were also sent to ophthalmic treatment centres for treatment and further observation.

Origin

Each coolie had been medically examined in China before embarkation; trachoma was the principal reason for the rejection of the men declined as unfit. Unfortunately the examining doctors in China were constantly changed, and there was therefore a varying standard of requirement for a "clean" eye, as well as a varying degree of experience in the detection of trachoma.

In each shipment there was a small number of impersonators who by "ways that are dark and tricks that are vain" contrived to elude the vigilance of the authorities; these formed one source of infection.

In addition there were necessarily a few cases which were infected before examination, but had not developed any signs of the disease which could be identified; these developed the typical granules on the journey to France.

But by far the most important source of infection was the case of chronic trachoma with a scarred and altered conjunctiva which, at the time of examination in China, was apparently quiescent. Shipboard life on a crowded transport provides ideal conditions for the lighting up of such a case to an inflamed and highly infective state, and for the rapid transfer of the disease to his immediate associates by the use of the common wash basin and the friendly exchange of towels.

One of the most striking features of the examinations in France has been the clear evidence of the infectivity of trachoma. The men came to us approximately in the order in which they were arranged on board ship. Again and again we have had a long string of men without a single case of manifest trachoma and then suddenly we came upon a series of five or six men all of whom were infected with trachoma. Almost always it was possible to pick out from among these men the one who was the source of infection; the conjunctiva tarsi marked by lines of white scar tissue and the intervening spaces standing out red and swollen. The other cases in the group were in the earliest stage where the trachoma granules just show as faint "ghosts" through the injected conjunctiva over the tarsal plate.

The voyage from China to France occupied about six weeks. This evidently provided sufficient time for the incubation of the disease and its development to a stage when it was easily recognizable.

Percentages

In the early drafts of coolies it was found that from 10 per cent. to 15 per cent. were suffering from trachoma when they arrived in France.

A further 20 per cent. to 25 per cent. of "conjunctivitis" were detained in hospital for treatment and observation. At least one half of these latter cleared up within a week, under treatment with zinc sulphate and boric acid drops, sufficiently to warrant their discharge as trachoma-free. Some 20 per cent. of them, as the associated conjunctivitis subsided, displayed the marks of trachoma and were drafted into "Z" companies. The balance were drafted into "Y" companies.

As soon as the heavy incidence of trachoma in the early drafts was recognised, a telegram was sent to the recruiting centres in China with instructions to require a stricter examination of the

eyes of the recruits, and to reject all men suffering from conjunctivitis. A routine application of the standard drops: Zinc. sulph. gr. 2, Ac. boric gr. 10, Aq. ad. oz. 1—was ordered to be made daily during the voyage to the eyes of all the coolies. The result of these more stringent precautions was a marked improvement in later drafts. The trachoma rate sank to 3 per cent., and sometimes as low as 1·6 per cent., while the conjunctivitis rate was about 10 per cent.

Method of examination

Each upper lid was fully everted. A marked feature of the examinations was the entire absence of symptoms in most of the cases of trachoma which were discovered. If eyes, which appear clean as far as external appearances are concerned, were passed without further examination, at least 90 per cent. of the cases would escape.

The method of eversion should be one in which soiling of the conjunctiva by contact with the fingers and the wholesale epilation of lashes are avoided. Where large numbers of men are to be examined, it must also be rapid and easily applicable to all sorts and conditions of lids.

The method used by one of us was as follows: Place the thumb of the right hand on the lower lid and grasp the skin of the upper lid between the thumb and second finger of the left hand. The patient is told to look down or to shut his eyes. A quick rolling motion backwards of the finger on the thumb everts the upper lid, and a pull downwards at the same time with the thumb on the lower lid exposes the inner surface of that lid and helps with the eversion of the upper lid. For the left eye the hands are reversed.

Another method of eversion was uniformly used by one of us. With the left hand resting on the forehead, the left thumb is placed on the upper lid, as close to the ciliary margin as possible; this is then drawn upwards to its extreme limit. The forefinger of the right hand is placed on the lower lid and by a rapid lateral movement of the forefinger, the whole lid is made to slide outwards across and in contact with the globe; some slight backward pressure being occasionally necessary. Simultaneously the left thumb is moved outwards a little and the upper lid then everts itself with a curl and a flick. One advantage of this method is that the more the patient resists, the more easily is the eversion accomplished. A disadvantage is that the final flick of the eversion is accompanied by a spurt of discharge from the eye (if any be present); hence the examiner should always wear goggles as a protection.

The upper lid must be thrown well over and particular attention paid to the outer and inner angles and to the convex border of the

tarsus. By moving the hand holding the upper lid first to one side and then towards the other, each angle can be smoothed out and carefully examined. Pressure backwards on the everted upper lid with a pull upwards will generally expose the conjunctiva of the upper fornix; as a rule in the Chinese the conjunctiva of the fornices is unusually redundant.

In order to detect the earliest stages of trachoma, it is essential to have a good light. Our examinations were always conducted out of doors in order that we might have direct sunlight. The examiner stood with his back to the sun, so that the light might come over either shoulder directly on to the eyes of the patient.

In everting the lid the use of force should be avoided as far as possible. If force is used, or the patient strains, the conjunctiva is rendered anaemic, and the trachoma granules do not show up by contrast; where force is necessary, time should be given for the blood to return to the conjunctiva before a decision is made. On the other hand, prolonged exposure to the atmosphere produces hyperaemia, and the real appearance is obscured.

As a rule, the best judgment can be given on the appearance of the lids when first everted.

Handling of the conjunctiva should be avoided. The edge of the lower lid may sometimes be pushed beneath the tarsal margin of the everted upper lid in order to expose it more fully. Occasionally it may be necessary to grasp the tarsus of the everted lid and partially evert again, in order to expose the depths of the upper fornix.

We found that the three of us were able to examine in a little over an hour 500 men from a draft with a heavy infection of trachoma, which necessitated frequent stoppages to send the rejected man to the proper collecting station, and to wash the hands before proceeding with the examination. In less heavily infected drafts, and with greater experience, we dealt with 750 men in one hour. One of us completed the re-examination of a "clean" company of 450 men in 50 minutes.

Diagnosis

The nature of the specific cause of trachoma is unknown, and we are still dependent on clinical evidence for diagnosis.

It is well to recall the natural course of the disease.

(1) In the early stages there are formed in the palpebral conjunctiva and fornices the *trachoma granules*, which microscopically exhibit the structure of lymphoid follicles. At this stage there is very little associated conjunctivitis, and the patient has little or no discomfort.

(2) Later there is more or less active vascular reaction of the

conjunctiva, with a luxuriant formation of *papillae*, due to the folding of the inflamed and hypertrophied mucous membrane. In this stage there is a certain amount of purulent discharge. The patients feel considerable inconvenience from the obscuring of vision by the discharge, and the feeling of weight and grittiness in the lid.

(3) Finally the follicles become absorbed or softened and extrude their contents on the surface. Their disappearance is associated with, and in part is due to, the development of fibrous tissue which produces *cicatrization* of the conjunctival surface of the lid.

A complication in the cornea which occurs in some cases during the latter two stages is *pannus*.

Therefore trachoma in the Chinese may be diagnosed or should be suspected if any of the following signs are present :

- (1) Granules in the conjunctiva,
- (2) Papillae in the conjunctiva;
- (3) Vascularization of the cornea,
- (4) Cicatrization in the conjunctiva.

Before dealing with these seriatim we should like to emphasize our conviction that it is impossible to be sure of the presence or absence of trachoma while the patient has acute catarrhal inflammation and considerable discharge from the eye. Quite often such eyes have a distinctly granular appearance of the conjunctiva; the conjunctival inflammation must first be abated and then an examination can determine whether trachoma is, or is not present, in addition. On several occasions we have seen cases marked by an examiner as "severe trachoma" clear up entirely after ten days' treatment with zinc and boric lotion.

(1) *Granules*. The usual text-book description of trachoma granules is "grey, translucent, roundish granules—found principally in the retro-tarsal folds" (Fuchs). This is by no means the form generally found in the early stages of the disease in Chinese. The retrotarsal folds are, as a rule, affected only in the later stages of the affection. Granules answering to the above description are more often seen in the conjunctiva on the convex edge of the tarsus. In the Chinese the granules most frequently appear scattered over the tarsus as small round cream-coloured points with an opalescent sheen which shew up distinctly in comparison with the hyperaemic conjunctiva. If there is much swelling of the conjunctiva, these deeply placed granules are often obscured; only when this swelling subsides under treatment, do they become visible and provide grounds for a diagnosis.

Translucent granules appearing in the lower lid, either in the fornix or near the margin of the lid, with no evidence of trachoma in the upper lid may generally be regarded as due to follicular conjunctivitis. Of course there is a remote possibility of trachoma.

occurring in the lower lid alone. Only the effects of treatment can finally decide; if they prove resistant to ordinary treatment and spread to the upper lid, it would point to trachoma as the correct diagnosis.

Atropin irritation may produce lymph follicles in the retrotarsal folds which may lead to the suspicion of trachoma. They clear up rapidly when the use of the drug is discontinued.

(2) *Papillae* are formed by the folding of the inflamed and hypertrophied mucous membrane. They are not peculiar to trachoma, but are apt to present themselves in any chronic inflammation of the conjunctiva.

In a well marked case they stand out as raspberry-like projections; when less marked they impart a velvety appearance to the palpebral conjunctiva.

In the Chinese well-marked papillae, *apart from profuse discharge* from the eye, are practically pathognomonic of trachoma. A velvety appearance is suspicious, but not definite; treatment with astringents must be used to reduce the swelling of the conjunctiva and allow the trachoma granules, if present, to appear, before a decision can be arrived at.

A fine stippled appearance of the conjunctiva (as if it had been struck with the bristles of a hair brush) is almost always due to a simple chronic conjunctivitis and clears up gradually under the use of a zinc lotion.

The most difficult cases to diagnose are those in which there are a few small raised points on the outer or inner angles of the everted upper lid—that is in the part of the conjunctiva which lies between the outer or inner limit of the tarsal plate and the corresponding angle of the eye. Quite frequently one or two fine raised points are seen on these small areas which can be distinguished by looking obliquely at the lid. At times these points have the appearance of small trachoma granules. We have come to regard these as suspicious, but not definite, so long as they are confined to these areas; if they encroach on the conjunctiva over the tarsal plate, we classify them as early trachoma. We are inclined to the opinion that these angles are in many cases the starting points of the disease.

(3) *Vascularization of the cornea*.—Pannus in the Chinese is pathognomonic of trachoma. It begins in, and is usually confined to, the upper part of the cornea.

The limited vascularization due to an ulcer of the cornea, must, of course, be excluded; as must also the deeper vascularization due to interstitial keratitis.

(4) *Cicatriziation*.—The cicatrices of old trachoma appear as narrow whitish striae in the midst of the red and thickened conjunctiva of the upper lid. They run chiefly in the

longitudinal direction, more or less parallel to the lid margin. Later there are intersecting striae which form a network, the interstices being occupied by red islands of inflamed and thickened conjunctiva.

The final condition is that in which the conjunctiva by contraction of the scar tissue has become perfectly pale, thin, and smooth, with generally a faint bluish tinge.

Short of the final stage we have rejected all cases with typical trachoma scars, because, until that stage is reached, it is impossible to be certain that quiescent cases will not relapse.

In conclusion we may say that at field examinations we feel confident in passing as trachoma-free any cases in which the Meibomian glands and ducts can be seen showing over the whole surface of the tarsal plate, and in which the normal vessels can be traced throughout their course in the conjunctiva tarsi. Any swelling which obscures the ducts and vessels calls for more careful inspection to see whether any of the above manifestations are present.

Differential Diagnosis

A few words may be added upon conditions which may lead to some hesitation in pronouncing a case free from trachoma.

(1) *Follicular conjunctivitis*.—This has already been dealt with above under "granules." In the Chinese a translucent granule in the lid is most likely to be trachoma, just as in Europeans the probabilities lie the other way. In follicular conjunctivitis the follicles predominate in the lower lids, are more elevated, more clearly domed and jelly-like, and are arranged more in rows like strings of pearls.

(2) *Chalazion*.—A small chalazion may rarely be mistaken for a trachoma granule; the colour seen through the conjunctiva is dull grey, and palpation between the thumb and finger shows the thickening of the lid at that point.

The granulation tissue protruding from a ruptured chalazion might be mistaken for papillae. Cicatrices left by numerous healed chalazia may simulate the cicatrices of trachoma.

Mere mention of these conditions is sufficient; a careful examination readily distinguishes them from trachoma.

(3) *Calcareous spots*.—These are frequently seen in the conjunctiva tarsi. They are whiter than trachoma granules and are often irregular in shape.

(4) A varicose condition of the upper fornix is not uncommon in the Chinese. The veins are enlarged and tortuous, and bulge the conjunctiva outwards at the bend of the vessels. If there is general injection of the conjunctiva, these points have sometimes the appearance of granules in the fornix.

(5) *Conjunctivitis vernalis*.—This is very rare in the Chinese.

If the granulations in the lids present the flattened, tessellated and pale opalescent appearance which suggests this disease, the conjunctival secretion should be examined to see whether it is rich in eosinophil cells, which sign would point to spring catarrh.

(6) *Tuberculosis of the conjunctiva (chronic hypertrophic)*.—This is a rare disease. It more often affects the lower than the upper lid. Pannus is sometimes present, but is generally more marked over the lower half of the cornea to correspond with the more usually affected lid. Usually it is accompanied by cervical or preauricular adenitis and there are generally other tuberculous lesions in the body.

Bacteriology of Associated Conjunctivitis

A bacteriological examination by Capt. H. D. Matthews, Bacteriologist of this hospital, of smears from 152 cases of "conjunctivitis" rejected at one inspection, gave the following results :—

No organisms found	...	...	68
Weeks's bacillus	...	...	25
Diplobacillus of Morax	...	...	52
Bacillus xerosis	...	...	17
Staphylococcus	...	...	1

Treatment

During two years trachoma cases were daily under treatment in this hospital, and every week were being drafted through it to trachoma centres elsewhere. They may be said to fall into three classes :

- (1) Those with subjective and objective *symptoms*.
- (2) Those without symptoms but with *diagnostic evidence* of trachoma.
- (3) Those either cured or with a mistaken diagnosis.

Class 1. The patients suffered from photophobia, lacrimation, and conjunctivitis, and presented on examination manifest signs of trachoma and sometimes its conjunctival and corneal complications. They were unfit for work and usually themselves complained of "sore eyes." This voluntary admission was noteworthy and at once placed the case in the class for active treatment; for, as a rule, the Chinese are not hypersensitive as regards their conjunctival sacs and can comfortably carry therein a foreign body or two without requiring attention.

Soon after the acute symptoms had cleared up, these patients were drafted off to trachoma centres in different parts of the country, where treatment in some form was continued without interfering with their daily work.

In *Class 2* showing definite trachoma without symptoms, we usually abstained from any active interference, being content with two or three days' mild treatment, such as protargol 5 per cent. three times a day, before sending them out to trachoma centres. We are convinced that for an indefinite period the disease in some of this class is arrested and will remain quiescent unless interrupted by injudicious treatment or by a long spell of working under dusty conditions. Pushing the treatment in these cases is an error likely to set up the complications described later.

In *Class 3*, allowing for a small proportion of errors in diagnosis, we had sufficient evidence in cases returning to hospital for other reasons from trachoma centres that numbers of undoubted cases became apparently cured; the question of immunity from future relapses, however, being always in doubt.

Our routine treatment in cases with acute symptoms was to paint the everted lids daily with silver nitrate 2 per cent. solution; when the inflammation and discharge had been checked and only the chronic trachomatous process remained, the lid was stimulated by the use of copper sulphate. Our rule of thumb has been: silver nitrate for acute, and copper sulphate for chronic cases.

For acute symptoms there is no more valuable medicament than silver nitrate 2 per cent. solution painted on the everted lids with a pledget of cotton wool once a day; the excess may be washed off with normal saline solution, but this is not really necessary. Under this treatment the acute symptoms subside within a week or ten days.

If the follicles in the lids are large and numerous, they should be expressed under cocain with Grady's forceps after a preliminary light scarification of the conjunctiva with a sharp knife. Silver nitrate 2 per cent. may be painted on the lids immediately after expression and applied daily thereafter. A cold compress on the eyes for a few hours after expression relieves the pain which is sometimes considerable.

When the acute symptoms have abated, the use of the copper sulphate crystal or lapis divinis stick, is the most effective agent in dealing with the trachomatous infection. The effect produced must be carefully watched, and if the eye shows signs of irritation and increased inflammation or if corneal ulcers appear, the copper sulphate should be abandoned temporarily in favour of milder measures. Corneal ulceration is always a contra-indication to the use of copper sulphate. Usually a case of trachoma in the chronic stage will tolerate and improve under a daily application of copper sulphate to the everted lid; it should be lightly rubbed over the conjunctiva and the excess washed off with boric lotion.

One of us (C.A.H.) after prolonged use of the copper sulphate crystal is less in favour of it. As usually applied, he believes it

produces an unequal and irregular scarring such as nature in its process of cure seldom does, and hence that the use of the crystal conduces to the complications of buckling of the tarsal plate and trichiasis. He prefers the daily use of copper sulphate drops—gr. 1 to the ounce—which gives an evenly distributed summation of caustic stimuli of safe degree and easy application.

For a change of treatment glyc. ac. tannic (1 in 8, *i.e.* half the B.P. strength) is very useful.

A great number of mild cases safely undergo spontaneous cure and continue their daily work without interruption from corneal complications under the daily use of zinc and boric lotion and protargol 5 per cent. (or, better still, protosil, which does not stain the conjunctiva).

With reference to the treatment of sequelae, we have tried most of the operations for entropion, but give preference to the method of splitting the lid margin, and grafting in the V-shaped marginal slit a strip of buccal mucosa. The graft adheres without stitches if the bleeding is arrested before it is applied. This method, which allows the lid to adapt itself to the curve of the globe, gave in our hands the best results. If the ptosis is marked we remove, in addition, a strip of the skin and underlying tissue of the lid, and anchor the lower edge of the skin incision to the upper margin of the tarsal cartilage, thus drawing the lash-bearing border upwards and turning the lashes outwards.

Prophylactic Treatment

The daily instillation of zinc and boric drops was ordered for every Chinese company in France, whether "X," "Y," or "Z." The usual method of application was as follows: The coolies squatted down in rows. An orderly, passing down the row behind the men, grasped each man's head, turning the face upwards, and resting the head against his body; he was able to draw the upper lids upwards, while the coolie himself pulled the lower lids downwards. A dresser, passing in front of the line with a pen-filler full of the drops, instilled a drop or two into the widely-opened eyes. By this method a company of 500 men could be treated in 20 minutes.

It is evident that such treatment was necessary in "Z" and "Y" companies, in addition to special treatment for the more serious cases. It was also of great value in "clean" companies, in keeping down the chronic conjunctivitis which is so common among the Chinese, and thus of lessening the danger of infection from sporadic cases of trachoma which might develop in the company.

It was also ordered that all face-towels should be sterilized by boiling twice a week. This order was designed to cope with the most frequent channel of infection from man to man, and also controlled the constant auto-infection of the owner of the towel.

Periodical inspections in the field of all "clean" companies were undertaken, in order to detect and remove to "Z" companies any cases of trachoma which had escaped detection at the first examination, and had developed subsequently.

These measures were extraordinarily successful in keeping down eye disease among the Chinese, and in minimizing the number of men off work from eye trouble. The number of men unable to work from this cause was infinitesimal; the average number of men off duty was between 0.025 and 0.09 per cent., and this was the same in the "Z" and "X" companies alike.

The freedom of the men affected with trachoma from serious complications, the prevention of the spread of the disease to the whole body of Chinese labourers, and the reduction of labour wastage from eye disease to such minute proportions, together constitute a noteworthy achievement in preventive medicine.

Even more important than this is the highly gratifying result that in no case, as far as we know, was the infection transferred to any white soldier or civilian from the large number of Chinese labourers suffering from trachoma.

Moreover, these Chinese themselves, as a result of the constant treatment and the education in ophthalmic hygiene, are in a very much better condition than they would have been if the disease had run its usual untreated course in their homeland. The ordinary sequelae—pannus, corneal ulceration, trichiasis and entropion (often culminating in blindness in one or both eyes) which are so terribly common in China, were very rare in these men. Not more than ten out of the body of eight thousand men in trachoma companies were repatriated on account of complications which disabled them from work.

We desire, in conclusion, to acknowledge the constant help given us in our work by Colonel W. T. Lister, Ophthalmic Consultant to the B.E.F., France, and by Lieutenant-Colonel G. D. Gray, the Commanding Officer of No. 3, Native Labour General Hospital, and their kind permission to publish the above record of our experience.

PERFORATING WOUNDS OF THE EYE

An investigation of 106 cases occurring in Soldiers at a
Military Ophthalmic Centre in London

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IN investigating these cases it is necessary to bear in mind that they only represent perforating wounds of a certain degree of