no inflammation of any portion of the renal tissue. The free iron reaction is very slight.

Intestines.

There is the only case, apart from those cases of proved bacillary dysentery associated with malaria, in which the intestines were examined microscopically. Considerable congestion of the vessels in the mucous and submucous layers of the gut is manifest, and numerous parasitic red cells are found in the vessels. Necrosis of the mucosa has occurred at various points, but there is no inflammation of the bowel wall to suggest a reaction from a bacillary infection. There are large areas of degeneration present with replacement of the muscular coat by mucoid tissue. This patient had not suffered from diarrhoea, and there was no history that he had passed blood or mucus; ulceration of the bowel wall, although present microscopically, was not observed at the autopsy, but the intestine from this area was deeply stained with bile. Whether this case is an example of necrosis of the bowel wall due to malaria, or an undiagnosed bacillary dysentery, is open to question, but against the latter view is the absence of evidence of inflammatory changes in the intestinal wall.

Causation of the Drastic Changes in the Tissues.

There is no question that the effects produced on the tissues in these cases of malaria which we have examined are widespread. Further, no other disease with which we are acquainted could have produced more drastic changes in the tissues. The rapid progress of the infection in so many cases on the one hand, and the cardio-vascular phenomena on the other, have led "some" to believe that this outbreak of malaria is different from all others.¹² It has been suggested, as one would expect, that this difference depends on the virgin soil which has been placed at the disposal of the parasites, or on the parasites, or on the quinine.

Special differences as regards the parasites must be left to the decision of those who have advanced this view. We cannot do better, however, than quote the remarks made by Sir Ronald Ross on this question. He says:—

Some authors consider that there are two, if not three, varieties (or ? species) of malignant parasites. I am inclined to agree with them, but have not yet satisfied myself on the point sufficiently to admit it in my classification.¹³

When we come to the question of quinine it is necessary to remember that the treatment of malaria depends on so many factors besides the mere administration of the drug that each of these should be considered on its own merits, more especially in relation to the fact that we are dealing with an army exposed to exceptional conditions of active service. As regards the toxic effect of quinine on the cardio-vascular system it is stated by Manson that it may produce depression, gastric disturbances, and even death from syncope. Professor A. R. Cushny, in a letter to me on this subject, states that he cannot supply any data to support the view that quinine is a cardio-vascular poison, but, on the other hand, he emphasises that as the drug has been used so extensively and under such special circumstances our views may have to be modified. These remarks by Professor Cushny, together with the views of those who have had wide experience of the successful treatment of malaria with quinine, seem to us to afford no evidence that quinine correctly administered is able to provoke such widespread toxic action on the tissues of the body.¹⁴ It has to be remembered that our French colleagues consider that the cause of these various effects on the tissues is due to the action of the malarial parasites; a view which has abundant evidence to support it.

Blocking of Blood-vessels in Malaria.

Complete or partial occlusion of blood-vessels with red cells heavily infected with parasites has long been known to occur in malaria. Bass and Johns offer an explanation for this phenomenon, which is as follows:—

The substance of malarial plasmodia is very different in consistency from that of red blood cells, and therefore they cannot pass through the smallest capillaries like the more yielding fluid-like red cell. That the consistency of the

protoplasm of the parasite is less yielding than that of the red blood cell is shown by the fact that when a small quantity of a culture containing large parasites is spread over a slide with the end of another slide, the parasites are dragged to the end of the spread, though the red blood cells are left behind.

This observation, however, refers to the smallest capillaries which are obstructed, while as a matter of fact it is not only the smallest but the large capillaries and arterioles which are plugged, and this vascular obstruction would seem to be most marked in the brain, spleen, and heart muscle. Heavy infection of the red cells with parasites will assist in obstructing the blood-supply by mechanical means quite apart from the general toxic action on the tissues and endothelium of blood-vessels; fatty degeneration of the heart muscle must lead to diminished blood pressure; while the changes in the adrenals are also of importance in this direction. It would appear probable, however, that blocking of blood-vessels with heavily infected red cells may be a temporary condition apart from the serious pathological lesions, thrombosis and embolism, while there is little doubt that obstruction of the blood-supply to the tissues in malarial fever is dependent upon many factors.

TREATMENT OF TUBERCULOUS EYES BY LOCAL APPLICATION OF TUBERCULIN.

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DURING the investigations into the cutaneous reactions of tuberculin, recorded in the article "Diagnosis of Tuberculosis by Tuberculin," published in *THE LANCET* (Oct. 7th, 1916), and certain other investigations into tuberculin reactions on lupus, not yet published, there arose a strong conviction that some form of local application of tuberculin would be the right way of treating the tuberculous conditions affecting the superficial tissues of the eye.

Up to the present the treatment of tuberculous eye conditions has been rather unsatisfactory, not only because of duration of the disease, but also on account of its great tendency to relapse. There has also been considerable difficulty in recognising which conditions were due to tuberculous infection and which were not.

Extent of Cases of Tuberculous Origin.

These tuberculous conditions seem especially prevalent in children, interfering not only with their welfare, but also with their education.

The early recognition of tuberculosis in many of the cases herein recorded was rendered possible by the systematic application of the multi-papillary-cutaneous method of diagnosis, which amply demonstrated that chronic eye affections in children were generally much more due to a tuberculous condition than would have been anticipated. In the cases observed every superficial part of the eye and appendages has been found to be tuberculously infected. The cases so far recorded have been blepharitis, phlyctenular conjunctivitis, and keratitis.

It is now routine practice to test every superficial recurrent inflammatory condition of the eyes and lids, generally with positive results, and the conclusion is being arrived at that nearly all superficial nebulae and maculae are of tuberculous origin. Of course, this generalisation does not include effects of superficial injuries, acute conjunctivitis, or the congestive conditions due to errors of refraction, but it is astonishing how often in the latter condition the congestion produced by these errors is complicated by tuberculosis; the error of refraction lighting up the tuberculous condition, and *vice versa*. It must be remembered that syphilitic and tuberculous eye affections may exist simultaneously. In fact, one case sent for diagnosis was undoubtedly syphilitic, but as a tuberculous reaction also occurred, the tuberculous element was treated for a short time, to the great improvement of

¹² It would be as well for all who believe this to be the case to study the work of Sir Ronald Ross on "The Prevention of Malaria" and the article on Malaria by Major Christophers, "Flies and Disease," by Edward Hindle. Cambridge, 1914.

¹³ Ross: *The Prevention of Malaria*, p. 89

¹⁴ Baermann reported in 1909 a death due to two doses of 0.5 gm. quinine hydrochloride—collapse, blood in dejecta, extravasation in organs. Quoted from "Prevention of Malaria," p. 136, by Sir Ronald Ross.

the subsequent syphilitic treatment, to which the case had previously proved refractory.

Up to the present, in the eye, deep tuberculous infections seem to be as much a rarity as syphilitic superficial ones are. The best demonstration of this superficiality is seen in tuberculous marginal blepharitis, where the eyelashes reappear after the cure of the tuberculous condition, though they have been absent for years.

The upper lid has only been twice found affected, and that has been on its free border. The upper sector of the eye does not seem to suffer from tuberculous invasion in the same proportion as the middle and lower sectors. This is so marked that it suggests that disease may be largely due to the deposit of tuberculous infected dust finding a lodgment in the superficial ocular tissues. There seems to be no doubt that localised tuberculosis is more prevalent, at least in its palpebral manifestation, in those whose general cutaneous hygiene is deficient. This accords with N. Bishop Harman's observation: "The dirty suffer twice as much as the clean." The large proportion of girls affected is interesting, and it suggests that the dust is domiciliary rather than external. The proportion in the cases recorded is 13 boys to 20 girls.

Results of Treatment.

Next in interest to the widespread existence of tuberculous infections of the superficial tissues in connexion with the eyes, which the use of the M.P.C. method revealed, came the further interest of the ease and simplicity of the treatment, and its almost wholly satisfactory results, leading to the publication of this article at present, instead of including it in a more complete investigation later.

All the cases so far treated have, up to date, proved curable, in any time from six weeks to three months, and so far only one relapse has occurred where the treatment has been completed, and this in spite of the fact that many of the cases have been continuously bad for years, and in some of the worst cases the complete freedom from attack has existed for over 18 months. Some of the children who are now attending school regularly have known little of school attendance before, and at present, in Middlesbrough, as far as is known, no case is absent from school for tuberculous eye conditions.

The cases treated have been mostly children, who form the large majority of sufferers from tuberculous diseases of the eye. A few adults are also included, though they have proved somewhat more refractory. They also have recovered. The total number of cases treated to date is 33, and are all recorded here, so that no selection has been made, and no case has been refused treatment.

Description of Method of Treatment.

The treatment is extremely simple and consists in instilling tuberculin into the conjunctival sac directly, in various dilutions of increasing strength. The eye thus gradually acquires a permanently raised resistance to the tuberculin poison, and so becomes no longer sensitive to local tuberculin reactions, as the result of congestive conditions produced by strain or irritation. The routine procedure is simple, and in the milder cases varies little. During the treatment the eye is kept uncovered, being only protected by a shade when photophobia is present. No atropine or other local drug is used, except where the reaction is excessive.

First in every case a cutaneous test is done on the forearm with tuberculin, using various strengths, from undiluted bovine tuberculin (P.T.O.) to 1 in 10,000 human tuberculin (T.), as explained in THE LANCET of Oct. 7th, quoted above; this is done not only to aid in diagnosis but to record susceptibility of the patient to tuberculin, a very important matter whenever tuberculin is used in treatment. Cases are by this means classified into the following definite classes, viz. :—

1. *Hypersensitive*, giving a marked reaction from IV. to VI. M.P.C., a dilution of T. from 1 in 500 to 1 in 10,000.
2. *Sensitives*, giving any reactions to III. M.P.C., or 1 in a 100 T. or doubtfully to IV. 1 in 500.
3. *Subsensitive*, giving a marked reaction to I. or II. M.P.C. original P.T.O. or 1 in 10 T.
4. *Insensitive*, either no reaction or only very slight one.

Tuberculin should be used differently in each of these types, as would naturally be expected, but in the past this phase of the question has not received sufficient attention in tabulating the result of tuberculin treatment, to the great detriment of the records and the use of tuberculin as a therapeutic agent. As a rule the cutaneous reaction in eye

cases demonstrates that they belong to the sensitive and hypersensitive classes, as would be expected, since they generally belong to the group of "double infections."

All cases up to date have been treated with bovine tuberculin, ordinary P.T.O. being used in tenths. It is as well here to put on record that all brands of P.T.O. are not similar in their reaction when applied to the same case, even when they are supplied by the same firm. This is very important, as a brand should be used that has been found cutaneously active to the case under treatment, as is demonstrated by the M.P.C. It is therefore advisable to use the same or a similar bottle for treatment as is used for the cutaneous reaction, where positive.

Dilutions are made in the usual way. One part of P.T.O. with 9 parts of diluent (normal saline and $\frac{1}{2}$ per cent. carbolic acid) forms Dilution 1. Then 1 part of Dilution 1 with 9 of diluent forms Dilution 2, and so on until eight dilutions have been made.

The method of recording is according to the dilution used, viz. :—

Original	...	...	...	...	=	Undiluted P.T.O.
Dilution 1	...	...	...	...	=	1 in 10 P.T.O.
Dilution 2	...	...	...	...	=	1 in 100 P.T.O.
Dilution 3	...	...	...	...	=	1 in 1000 P.T.O.

And so on to Dilution 8.

Ordinary "Sensitive" Cases.

If the case is an ordinary "sensitive," not responding to more than III. M.P.C., a start is made with Dilution 6, which is instilled into the eyes whether inflamed or not—usually one eye is inflamed at the start, the reason for seeking treatment. It is customary to instil the dilution into both eyes simultaneously, and an ordinary T. syringe is used which directs a small stream with certainty. It appears desirable to encourage engorgement of the vessels after instillation rather than not, as it is believed to stimulate the absorption of the tuberculin. No child has cried after the second instillation. The instillation is repeated every two or three days if the time is urgent, otherwise twice weekly is the usual practice. It is always advisable to see the eyes on the day following an injection to observe and record the result of the treatment, which is sometimes magical to inflammatory condition. Records should always be made, as it will be found necessary to refer back to them later in the treatment if any unexpected result arises. The object of the next day's inspection is not to note the improvement however, but to note and record the result of the reaction, if any, as reaction is the keynote of this as of all other tuberculin treatments.

Should no undue reaction occur, and even if there should be some increase of the existing inflammation, in two or three days' time the instillation is repeated, using the same dilution in the same manner. Next week, or the third time of instilling, the dilution is raised to Dilution 5, which is repeated a second time in the same manner after two or three days' interval. By the fourth instillation the inflammation is usually materially reduced or gone altogether, but that will be considered later. After the fourth instillation the dilution is again raised, and Dilution 4 is instilled twice in the same manner. The next week Dilution 3 is used. Up to this point practically no precautions are necessary in ordinary sensitive cases, as the case should show continuous improvement, and even all secondary congestion will usually by now have disappeared.

As a matter of fact, up to Dilution 3, frequently the dilutions are instilled three times a week, instead of twice, as this materially shortens the treatment, and so far no reactions have been primarily produced with a weaker dilution, except in hypersensitive cases, which will be dealt with later. With Dilution 3, however, more precaution must be observed, and instillation should never be made more often than twice a week, and the repetition of all doses is essential. This is frequently omitted in the weaker dilutions to shorten the time of treatment, when it is considered no undue risks are being incurred. Still, the duplication of the dose is the safer procedure in routine practice with those who have not learnt to differentiate the various grades of sensitiveness.

After Dilution 3, reactions occur more frequently, but not usually in ordinary sensitive cases. It is as well to use Dilution 2 three times, and after that Dilution 1 is repeated as often as necessary. A beginner is advised before using Dilution 1 (equal to 1 in 10 P.T.O.) to use Dilution 1 diluted by half its bulk in diluent (1 in 50), using this once, and if there is no reaction proceeding to Dilution 1.

Dilution 1 is now considered the end of the treatment. In a few cases original P.T.O. has been used, but this has been abandoned in routine practice as unnecessary and liable occasionally to produce an undesirable reaction, though a reaction did not necessarily follow on its use.

In hypersensitive cases Dilution 2 is often the termination of the local treatment where weaker dilutions show a tendency to produce an undue reaction, but one does not feel so safe from relapses as where Dilution 1 has been used without producing reaction. When this occurs the case can be considered permanently relieved and the patient should then

be found able to face wind and eye fatigue without any recurrence of the inflammation.

This even holds in chronic phlyctenular conditions where the refraction has not been corrected—possibly the most conclusive test of all. Needless to say, it is always well to have such errors of refraction properly corrected.

A reaction is recognised either by a fresh inflammatory patch appearing, or an increase of the already existing inflammation, or even slight local congestion in an eye previously normal. When a reaction does occur it is immaterial at what point in the series, as the treatment is similar. If the reaction is mild, wait for a few days until it has subsided and repeat the dose, making the intervals between subsequent doses longer, and raising the dilutions more cautiously, possibly repeating a dose three times instead of twice.

This is all that will be found necessary in the vast majority of cases, the treatment being carried out usually without further interruption until the safety point has been reached.

Hypersensitive Cases.

We come now to the consideration of the hypersensitive cases.

Hypersensitive cases are those giving a marked reaction to (IV.) M.P.C. 1 in 500 or any reaction to (V.) or (VI.) M.P.C. The characteristic of all hypersensitive cases, as indicated by their M.P.C. reaction, is their marked irritability to tuberculin; this is especially apparent in the weaker dilutions and is present both in local applications and all forms of injection. When eye cases are hypersensitive it will be found, on inquiring into their history, that their attacks of inflammation have been of longer duration and more intractable, and with shorter free intervals between the attacks, than occurs in the ordinary sensitive case. In these hypersensitive cases the instilling of tuberculin has to be done much more cautiously, since they show, as has been said, a marked sensitiveness even to weaker dilutions of tuberculin. The treatment is thus naturally much more prolonged. All signs of a reaction must be watched for and responded to more carefully. It is advisable in these cases, at least until the resulting conditions become familiar, to start their treatment with Dilution 8 instead of Dilution 6; advance must be made cautiously, but nevertheless it will be found possible to advance the dose with considerable regularity if at a slower rate than in the sensitive cases.

When dealing with a hypersensitive case after it has quieted down and a reaction is reached, sometimes a repeated dose of the same strength will give a greater reaction than the first, and the third repetition may even produce a still greater reaction. In these cases it is as well to go back to Dilution 6 or 8 and begin *de novo*, especially when the reaction is excessive and slow in subsiding. These increasing reactions are in the nature of an anaphylaxis, and on that theory were found better treated with weaker dilutions than by none at all, as a more rapid quieting down was effected. Benefit is often derived by giving small injections of P.T.O. subcutaneously and simultaneously, say, 1/10 c.c. Dilution 7 or 8 already prepared for eye instillation, cautiously raising these doses by tenths. Atropine ointment has been found materially to control the reaction even where there is no great congestion at the sclero-corneal margin, in which case it would have naturally been used in routine practice. The action of atropine also permits in these cases a more active treatment.

It will be remembered that atropine sulphate has been found to have a protective action against the asphyxia of acute anaphylaxis in the guinea-pig, and is also used with advantage in serum sickness. Hyperæmia is best controlled and the pain at the same time relieved by instilling a dilution of adrenalin and eucaine or having an ointment made. The following are the strengths used—viz., adrenalin, 1 in 2000; eucaine, 1 in 100. The writers are quite aware that the procedure is not always advisable in ordinary inflammations, especially ulcerative, but in these cases where dealing with acute hypersensitive reaction it has been found useful, but should only be used a few times.

The Production of Reactions.

In normal sensitive cases that are only sensitive to M.P.C. III. these reactions should rarely be seen, but in the hypersensitives they cannot sometimes be avoided, though as experience has grown they have become of less frequent occurrence. Really the study of reactions on the eye generally has been made during the removal of superficial nebulæ of tuberculous origin, the results of previous inflammations. In these cases a certain amount of reaction is necessary. When the removal of opacities is undertaken the treatment is best commenced while the eye is quiescent. The doses are rapidly increased until a reaction is reached, since that is what is desired, as some part of the opacity is generally removed at each subsidence of the congestive symptoms. Then the eye is allowed to rest again. If the case is not anaphylactic the reacting dose is again repeated, generally with a slighter reaction, and when this has subsided a stronger dose is given if that is found necessary to produce the essential reaction.

The removal of the opacities occurs during the subsidence of congestion, each time a little more disappearing, until, if the treatment is persevered in, quite marked opacities can be got rid of and the sight materially improved. If, however, the case be hypersensitive the reaction has to be worked up to each time from weaker dilutions, and this will occasionally reveal a lower reacting point, when, of course, that will then become the one used till it ceases to react. Especial care must be taken in these cases that the reaction shall be brought into complete control before another one is used.

Up to the present only dilutions of P.T.O. have been used for this eye work, and as they have been found entirely efficient there has as yet been no need to use other varieties of tuberculin. The results of the use of other varieties would, no doubt, be interesting. There would not be any hesitation in using O.T. if the necessary reaction could not be obtained otherwise, but undiluted P.T.O. has up to the present been the strongest used except once, when 3, 2, and 1 dilutions of T. were used subsequently. If a case gave a negative P.T.O. and positive T. the latter, I imagine, would be indicated.

Observations on the Tissue Reactions to Tuberculin.

It is not intended in this paper to discuss the views held by the writers on tuberculin effects in tissue reactions as they would be too lengthy, and the investigations now being made are not yet sufficiently complete. Sufficient to say that the treatment was arrived at during the consideration of tuberculous conditions other than eyes, but the deductions arrived at suggested that tuberculin applied directly should be the proper way of treating tuberculosis of the eye itself; but even then the dramatic results that followed the treatment were unexpected, and it was this success which made the separate publication advisable, although really only a small part of a much more extended and far-reaching series of investigations which will require some time to complete. There was naturally some hesitation before applying this method for fear of excessive eye reaction, about which so many warnings have been given in the literature of the subject, of which it is only necessary to quote from one of the best books on tuberculin treatment by Hamman and Wolman. Writing of the conjunctival tests, using 1 per cent. dilution of T., they say (pp. 130-131):—

“The conjunctival test should never be repeated in the same conjunctiva. Such repetitions are dangerous, and the information they afford is of no clinical value. We have repeatedly spoken of the sensitising action of tuberculin. In no position is the local stimulation so well illustrated as in the conjunctiva.” “The reactions to the second instillation are often alarmingly severe.” “Any existing inflammatory disease of the eye is an absolute contra-indication to the test. A history of previous inflammatory disease, especially of phlyctenular conjunctivitis, is likewise a contra-indication. The tests should not be performed in the presence of severe conjunctivitis.” “The tests should not be given to manifestly scrofulous children, as they so frequently react violently to tuberculin.” (Note.—They are generally hypersensitives.) “The presence of conjunctivitis or eczema about the eyelids, so common in these children, is an absolute contra-indication to the test.” (These conditions are tuberculous, and should be treated as above indicated.)

In absolute fairness to the authors it must be stated that these observations are quite correct, as they refer to dilution of 1 per cent. of T. for diagnostic test purposes. They also indicate clearly why treatment should be begun with weak dilutions, but they are quoted to show why, holding similar views of the danger of careless eye tuberculin tests, there was considerable hesitation before applying tuberculin locally to the eye, even when work on other phases had suggested that it was the proper treatment.

It equally demonstrates why the treatment should be used with some circumspection by the uninitiated. So that those using tuberculin may not be deterred from affording their patients the relief available, a further quotation from Hamman and Wolman, in their general conclusions as regards the tuberculin conjunctival test, may aid. They say (p. 130):—

“We wish only to state here that our own experience has led us to believe that the serious results which have followed conjunctival tuberculin instillations can with proper precautions be minimised, if not completely avoided, and that the risk run is not great enough to force the abandonment of a procedure which has proved itself of such value in diagnosis.”

Other Points in Treatment.

One other matter of suggestive interest may be recalled before dealing with the cases themselves; it is the reaction on the cornea of abrin, the active principle of jequirity

seeds, which has a peculiarly powerful effect in producing inflammation.

It has been shown in the rabbit that an eye could be immunised with gradually increasing doses of abrin applied locally, so that when immunity was reached the inflammatory effect would no longer occur. It was further shown that if a fatal dose of abrin was triturated with the immunised conjunctiva after its removal from the dead animal and injected into a live animal the dose would no longer prove fatal, but if the untreated conjunctiva of the original animal was treated with a fatal dose and injected into another rabbit it in no way interfered with the effect of the dose, which was fatal as usual, demonstrating that the antibody immunising effect was local to the conjunctiva actually immunised. The definite antibodies are apparently retained in the conjunctival tissue. In this connexion it may be stated that evidence points to the tuberculin effect in the eye being somewhat similarly a local condition.

Table showing all Tuberculous Eye Cases Treated.

No.	Disease.	Sex.	Age.	Eye.	Duration of illness.	M.P.C.	Primary treatment.	Doses.	Up to.	Secondary treatment, nebulae or leucoma.	Doses.	Time elapsed since cure.
1	Corneal ulcers	M	8 B	7 yrs.	6	10	16	Orig. P.T.O.	4 mths	19	15	Mths.
2	"	M	10 B	3 "	6	6	12	1	—	—	—	12
3	"	F	15 B	4 "	5	14	22	1	4 mths	21	4	4
4	"	F	12 B	6 "	3	10	18	2	5 "	27	9	9
5	Phlyctenular conjunctivitis	F	11 B	10 "	4	8	14	1½	—	—	—	6
6	Phlyctens.	M	7 B	1½ "	4	8	12	1½	—	—	—	9
7	Corneal ulcers	M	5 L	3 mths	4	6	7	1	—	—	—	10
8	Photophobia.	F	6 B	3 yrs.	2	8	29	1	8 mths	33	—	—
9	Corneal ulcers	F	8 B	1½ "	3	12	21	1	—	—	—	9
10	"	F	9 B	4 "	4	8	11	3	—	—	—	4
11	Phlyctens.	F	10 B	4 "	5	11	13	Orig.	3 mths	15	—	—
12	Keratitis.	F	34 B	7 "	6	11	22	3	2 "	6	—	—
13	Corneal ulcers	F	18 B	3 "	5	14	29	1½	—	—	—	11
14	Blepharitis.	M	12 B	3 "	3	9	10	2	—	—	—	5
15	Corneal ulcers	F	7 B	1½ "	3	10	17	2	10 mths	25	—	—
16	Phlyctens.	F	8 B	2 "	2	6	10	1	—	—	—	7
17	"	F	11 B	9 mths	2	6	7	3	—	—	—	8
18	"	F	9 B	2 yrs.	1	9	18	1	—	—	—	14
19	Corneal ulcers	F	12 B	5 "	4	7	13	1	2 mths U.T.	8	—	—
20	"	F	9 B	4 "	6	4	11	3	—	—	—	—
21	"	M	7 B	5 "	5	20	23	1	2 mths U.T.	6	—	—
22	"	F	12 B	4 "	6	6	10	5	U.T.	—	—	—
23	Phlyctens.	M	16 R	2 "	6	8	16	1½	—	—	—	4
24	Corneal ulcers	M	19 B	3 mths	3	6	9	1	—	—	—	4
25	Conjunctivitis, corneal opacities.	M	10 B	8 "	6	14	35	3	U.T.	—	—	—
26	Phlyctens.	F	8 B	2 yrs.	5	11	18	2	—	—	—	4
27	Ulcers.	M	40 B	6 "	4	14	12	2	—	—	—	3
28	Corneal ulcers, iritis.	M	33 B	All life.	3	13	28	5	U.T.	—	—	—
29	Corneal ulcers	M	6 L	4 mths	5	7	10	1	—	—	—	3
30	Phlyctens, blepharitis.	F	8 B	5 "	4	5	11	1	—	—	—	2
31	Corneal ulcers, blepharitis.	F	4½ B	4 yrs.	3	6	16	3	—	—	—	1
32	Corneal ulcers	F	8 B	7 mths	4	12	26	2	—	—	—	2
33	"	M	2½ L	14 "	3	6	10	Orig. P.T.O.	—	—	—	13

B. = Both. U.T. = Still under treatment.

Complications.—Cases 1, 3, 4, 6, 19, and 23, suppurating glands of neck; 2, bad lupus on face; 5, neck glands, not suppurating; 11, died pneumonia; 12, spine; 15, meningitis, suppurating glands; 25, lupus on side; 32, lupus on nose.

Usually both eyes are treated simultaneously, whether they are inflamed or not, but in a couple of cases one eye was so bad that it was treated by itself lest a flare in the other eye might be produced simultaneously. It was then found on subsequent instillation into the untreated eye no immunity had been produced in it. This is the reason why the practice is adopted of instilling dilutions of tuberculin into both eyes simultaneously whether affected or not, which is now routine procedure.

It must also be remembered in favour of treating both eyes simultaneously that the instilling of the solution into the bad eye alone may cause, when the stronger dilutions are reached, quite a bad flare up in the good one if there happens to be any latent focus to be sensitised.

A subsequent course of subcutaneous tuberculin is usually carried out with a view of consolidating the treatment.

During the whole time of the treatment it has been found advantageous to administer calcium chloride, the formula used being: calc. chloride, 3 x.; syrup, 3 iii. Of this 5 to 30 min.

is given according to age, stirred up in a cup of milk, after food. In this form direct fresh combination seems to occur with the milk and it is readily absorbed. Cases refractory to the taking of calcium chloride are much more difficult to control, and observations extending over a number of years lead to the conclusion that there is some special interaction in tuberculous cases, which is not unlikely when the general relation of calcium chloride to the tissues is remembered. It is only necessary to refer to the action of calcium chloride preventing the absorption of potassium in ordinary muscle cell metabolism.

NOTES ON

THE DRAINAGE OF AN INFECTED HÆMOTHORAX.

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THE large majority of penetrating wounds of the chest give rise to hæmothorax of greater or less degree. The cases of hæmothorax admitted into base hospitals fall practically into three groups:—

1. Those presenting evidence, clinical or bacteriological, of infection from the onset.

2. Those appearing at first to be sterile which later, often about the tenth to fourteenth day after the wound, show evidence of infection.

3. Those which run a "sterile course" throughout. Some in this class, doubtless, are mildly infected, but clear up without surgical treatment.

The percentage of infected cases differs a good deal in various series of cases which have been published. Bradford and Elliot¹ in 323 cases of hæmothorax found 117 to be infected, Howard² in 65 cases had 9 infected, Menzies³ in 70 had 21. Among 108 cases of hæmothorax I found infection in 31.

The first two classes of case given above usually reach the operating theatre sooner or later for drainage of the pleural cavity. Certain types of infected hæmothorax clear up satisfactorily without continuous drainage—that is, by aspiration alone. A sample of the fluid is obtained by the exploring syringe and sent to the bacteriologist. If he reports, as sometimes happens, a very slight growth in culture of some organism or growth after a long interval only we may assume that the sample contained very few organisms. This may mean either contamination of a sterile sample or a very slight infection. Such cases, so long as they are progressing satisfactorily, may be regarded as sterile and treated by aspiration alone. Picqué⁴ claims to have cured 31 out of 48 cases of infected hæmothorax by aspiration, begun as early as possible and repeated as often as necessary. This treatment is the more likely to succeed if the infection is endogenous—i.e., by organisms derived from the respiratory tract, such as the pneumococcus, *B. influenzae*, and *M. tetragenus*. Endogenous infection is present in rather less than 20 per cent. of infected cases according to Elliot and Henry.⁵

Often the first bacteriological report on a hæmothorax sample is "sterile," but as the patient is not doing well he is explored again some days later, and the fluid is now reported infected. Presumably in such cases we have infecting organisms shut off in blood clot. Under congenial conditions of warmth and food-supply they gradually multiply and in time spread throughout the pool of blood, so leading to the absorption of toxins, increase of the effusion, possibly the production of gas, and the clinical picture of infection. At times the change from the apparently sterile to the obviously infected aspect is quite sudden.

Assuming drainage of the pleural cavity to be proposed for a case, the object of this paper is to bring together a few commonplace points in the method of doing the operation and in carrying out the after-treatment. The dressing and after-care of these cases is not always the simple matter it appears to be at first sight.

Method of Performing Resection of Rib.

Simple thoracotomy, without resection of rib, may be tried when the patient is gravely ill, and the prime indication is