viâ the blood or lymph. As the cornea is normally avascular the lymph spaces would appear to be the only road of infection for that tissue. The disease, however, appears primarily to affect what is morphologically the conjunctival portion of the cornea, extending deeper beneath Bowman's membrane later. Iwanoff has shown it to be an infiltration round the nerves, and this may account for the pain and photophobia. This photophobia and reflex spasm of the lids are characteristic signs of this disease and have always seemed to me to have a direct connection with involvement of the fifth nerve terminations. Is it possible that in these cases the fifth nerve is hypersensitive to tubercle toxin, if not actually acted upon by it? In such a case the disease may have some pathological relationship to herpes.

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THE USE OF TUBERCULIN IN EYE DISEASES

BY

FR. VERHEYDEN, M.D. Louvain.

LATE CHIEF ASSISTANT TO THE EYE DEPARTMENT, POLYCLINIC, BRUSSELS;
TEMPORARY ASSISTANT SURGEON TO THE EYE, EAR, AND THROAT HOSPITAL,
SHREWSBURY.

MY object is to lay before my readers, and to sum up briefly, the results of nearly three years' experiments, partly by Drs. C. G. Russ Wood and F. A. Anderson, and partly by myself, of the continued and systematic use of tuberculin in a number of eye diseases.

Cases of "strumous" affections, such as keratitis strumosa, keratoconjunctivitis, miliary keratitis, tuberculous iritis, irido-cyclitis, episcleritis, scleritis, central tuberculous choroiditis, and tuberculous paralysis of the third nerve, were at different times submitted to the treatment.

Keratitis strumosa in its various manifestations

All used to hospital ophthalmic work, know how disappointing may be the treatment of the above-named disease. These forms of localized tuberculosis common in children are an ideal field for tuberculin treatment in small doses. The treatment is best given in hospital, because definite and precise precautions should be taken to spare the patients avoidable inconveniences. This disease, so

various in its manifestations and met with where conditions of life are defective; with poor food, and in large families, frequently recurs, after everything has been tried to improve the patient's condition. As a final result of prolonged treatment, we see large and numerous nebulae of the cornea, which impair the sight, and may cause the development of myopia in children. It is most satisfactory to notice how quickly under the influence of tuberculin injections this troublesome disease subsides. The photophobia, blepharospasm, and hyperaemia, with concomitant lacrymation, are in a few days much relieved, in certain cases disappearing altogether. Success is not the reward in every case; we see patients coming back with recurrence, but repeated injection intensifies the benefit of the first. The final results are good and the treatment is much shortened. The cure is associated with the use of atropin ointment in the diseased eye each time there is any indication. The preparation of the injections, their dosage, and some other features of the method will be dealt with at the end of this article. The treatment in cases of keratitis strumosa clears up the aetiology by the reaction the patient shows locally and generally. Experience shows how the dose may be gradually increased at intervals, so that a practical immunization with all its benefits occurs. Cases demonstrating these observations are not given, only more important histories in the more obscure diseases being related.

Scleritis and Episcleritis

Obscure as is their origin, we may to-day safely state that many cases of scleritis and episcleritis are tuberculous, and can be dealt with, if only slowly, in a satisfactory manner by the use of tuberculin. Before coming to the conclusion of a tuberculous aetiology, we must in every case carefully exclude gout, rheumatism, malaria, menstrual disorders, syphilis, or late gonococcal infection. Early treatment may perhaps in cases of deep scleritis prevent the iris and the choroid being involved; suppose we only spare the patient this complication it is invaluable.

Case of J. D., 27 years.—*August* 16, 1916.—R.V.=6/6, L.V.=6/18. Typical nodular episcleritis.

August 25.—Injection T.O. 0.0001 c.c.

August 26.—Temp.=102.4°. Local and focal reaction.

September 1.—Injection T.O. 0.0001 c.c.

September 2.—Temp.=99°.

September 3.—Temp.=101°. Intense local and focal reaction. During the following days the eye progressively improved.

September 3.—Subconjunctival injection of Wright's saline solution in the diseased eye. Atropin was freely used locally, three times a day, combined with the general treatment.

October 18.—When seen for the last time this man felt very

comfortable, all acute symptoms were gone, and the eye was perfectly quiet.

Iritis and Irido-cyclitis

The use of tuberculin throws a very strong light on the prognosis and the treatment of tuberculous diseases of the uveal tract, especially of the iris and the ciliary processes. In tuberculous iritis or irido-cyclitis, interstitial trouble of the cornea, associated with "keratitis punctata" often overshadows the primary lesions which are the substratum of the disease.

Case of Private A., aged 25 years. *July* 23, 1916. R.V.=6/6, L.V.=Hand movement. Intense photophobia, infiltration of the cornea, "keratitis punctata," intense pericorneal injection, pupil small.

July 24.—Injection T.O. 0.0001 c.c.

July 25.—No reaction, either local or focal, no rise in temperature.

July 27.—Injection T.O. 0.0001 c.c.

July 28.—Local but no focal reaction. Temperature 100°.

August 2.—Injection T.O. 0.001 c.c.

August 3.—Local and focal reaction. Temperature 102°. We thought the rise in temperature too high, and returned to smaller doses.

August 18.—Injection T.O. 0.0001 c.c.

August 19.—Temperature 98°.6. Neither local nor focal reaction.

September 12.—Subconjunctival injection of Wright's saline solution.

September 16.—R.V.=6/6, L.V.=6/18. T.O. 0.0005 c.c. No reaction.

September 22.—Injection T.O. 0.001 c.c. No reaction.

Atropin was used three times a day during treatment. Each time focal reaction was present, the condition of the cornea improved quickly on the following day, the infiltration and "keratitis punctata" progressively giving way; and at the same time the pupil dilating better.

Private A. left hospital at the end of September, and is now with the Army in France. Only small interstitial opacities were left, the pupil reacting well, and every trace of "keratitis punctata" having gone. In this case the tuberculous origin was confirmed by characteristic cicatricial patches of the skin of the right arm just below the elbow, looking like the cicatrices of lupus.

We believe that all cases of chronic irido-cyclitis, also when associated with choroido-retinitis, are fields for investigation with tuberculin treatment. In some cases the results were negative, in others positive; but, generally speaking, in these lesions, especially

when of old standing, and when the diagnosis has been confirmed late, the results were slower and less brilliant than in earlier infections, because profound disorganization in the layers of the retina and choroid has occurred.

Central tuberculous choroiditis

We only saw one case at an early stage.

Gwen C., 18 years. *August* 18, 1916. Came to the hospital because the sight had been failing in the right eye for a week. R.V. = fingers at 2 feet. L.V. = 6/6. The cornea was slightly hazy, with "keratitis punctata," there was slight pericorneal injection, the pupil was rather dilated; the vitreous hazy, but allowed us to see the macular lesion as one indistinct white patch slightly raised above the level of the retina. The patient was first submitted to a ten days' course of guaiacol diaphoresis, thinking the lesions too acute to use tuberculin at once, and fearing a miliary generalization in the eye. We started injections of tuberculin on August 30 with the ordinary initial doses, T.O. 0.0001 c.c.

August 31.—No local reaction. Temp. 99.8°.

September 3.—R.V. = 3/60 and L.V. = 6/6.

September 14.—R.V. = 6/60. L.V. = 6/6. There was still a slight rise of temperature daily, which on September 14 was 100.1°, contra-indicating further injections for the time being.

September 15.—Temp. 99.4°.

September 17.—Temp. normal. Injection of T.O. 0.0001 c.c.

September 18.—No reaction either local or focal; no rise in temperature.

September 20.—Injection of T.O. 0.0001 c.c., followed by slight local reaction only. On September 23, the lesion of the fundus was a patch of choroiditis strictly limited to the macular region accounting for the defective vision.

Paralysis of the third nerve of tuberculous origin

The case we now refer to was first seen by Dr. C. G. Russ Wood on October 13, 1913. Partial ptosis was present in both eyes, no paralysis of internal recti or obliques; the right superior rectus was paralysed. The patient's principal complaint was recurrent drooping of the lids with intense headaches. This case was looked upon by Dr. C. G. Russ Wood and several colleagues as an instance of myasthenia gravis, in relation to the history given. At a meeting of the Midland Ophthalmological Society several members came to the same conclusion after examination of the patient; but a suggestion of possible tuberculous origin was made. Tuberculin treatment was suggested.

April 29.—Injection T.O. 0.0001 c.c.

May 1.—Local reaction. Temp.=99.2°. The next day the patient opened her eyes well.

May 5.—Slight diplopia, and slight limitation of movements of the globe upwards.

May 11.—Practically no ptosis. Injection T.O. 0.001 c.c.

May 14.—Severe malaise, pain in arm and in the eye.

May 21.—No ptosis, movements of the eye still limited upwards.

June 4.—Injection T.O. 0.001 c.c., followed by local and focal reaction.

June 20.—Ptosis recurred; diplopia more pronounced. Injection T.O. .001 c.c.

August 2.—Diplopia ceased a week after last injection.

January 7, 1915.—Recurring diplopia and ptosis. Came into the hospital to have a course of injections. Injection T.O. 0.002 c.c. Slight reaction.

January 15.—Injection T.O. 0.003 c.c. Very slight reaction.

January 18.—Injection T.O. 0.006 c.c. Slight reaction.

January 19.—Injection T.O. 0.009 c.c. No reaction.

The patient was seen for the last time on April 4, 1916, when she was fit and comfortable. The course of the disease in this patient points distinctly to the tuberculous origin of the trouble. There was somewhere in the course of the third nerve a tuberculous deposit responsible for the symptoms. No signs were available for exact localization.

I look on this, and the previous case, as showing the value of tuberculin: first, as confirming a doubtful diagnosis, and, secondly, as a precious adjuvant to the curative agents we may handle with success where everything else has failed.

Preparation of and ways to use tuberculin

After several trials, Dr. Anderson, whose method we adopted, decided to use old tuberculin, as prepared by Messrs. Burroughs, Wellcome & Co.

All aseptic precautions being taken, and everything used being sterile and clean, 1 c.c. of old tuberculin is diluted with 9 c.c. of a solution of normal saline to which has been added .50 per cent. of lysol. This gives 10 c.c. of solution T.O. .1.

1 c.c. of T.O. 0.1 is diluted with 9 c.c. of the same, and gives 10 c.cm. of T.O. 0.01.

1 c.cm. of T.O. 0.01 is diluted with 9 c.c. of the same, and gives 10 c.c. of T.O. c.c. 0.001.

1 c.cm. of T.O. 0.001 is diluted with 9 c.c. of the same, and gives 10 c.c. of T.O. 0.0001.

Usually we do not dilute more, using 0.5 c.c. of solution T.O. 0.001 in cases where special care is to be taken; this brings the

initial dose to T.O. 0.00005. In exceptional cases treatment may be started by T.O. 0.00001.

Before submitting any patient to tuberculin injections, the urine should be tested. The slightest rise in temperature causes the treatment to be postponed until the temperature is normal.

Reactions after tuberculin injections

The patient submitted to the initial dose of, say, T.O. 0.0001, may behave in several ways; and safety requires that he should be kept in bed, the temperature being taken every four hours. There may be no reaction, either local or focal, and no rise in temperature.

The rise in temperature may be the sole sign of reaction.

There may be a slight local but no focal reaction, nor rise in temperature. Local and focal reaction may be present, together with a rise of temperature.

Focal reaction means the flooding of tuberculous areas with blood carrying antibodies; it is observed in visible lesions and is most important. A rise of temperature means the body defending itself against actual infection.

We should call an ideal reaction after tuberculin injection a rise to 100°F., slight headache and nausea being present. Locally, a red patch about one inch in diameter, slightly swollen above surrounding tissue, constitutes the typical reaction; in the eye slight pain may be present, with concomitant increased redness. When these mild symptoms occur, the initial strength of the first dose is not to be increased. T.O. 0.001 c.c. solution will only be used when no more reaction can be elicited by T.O. 0.0001 c.c.; and T.O. 0.01 c.c. when T.O. 0.001 leaves the patient without reaction at all. When after injection of T.O. 0.001 the temperature rises to 102°F. and the patient feels intense malaise, and there is intense local reaction, with pain and swelling; T.O. 0.0001 should be used as long as the reaction is so violent. The same procedure is to be applied in connection with the stronger solutions. Locally when reaction is too violent, antiphlogistine is to be applied, and the patient kept in bed on light diet.

When solution T.O. 0.0001 c.c. is too strong 0.5 c.cm of the same, or T.O. 0.00005 c.c. should be given as the initial dose. In a negative result, when T.O. 0.0001 c.c. shows no reaction at all, the strength is gradually increased until a reaction takes place. If the results are still the same, a negative conclusion will be justified.

Concomitant Treatment

Two days after the injection of tuberculin, dionin, 4 per cent. solution, should be used, one drop three times in succession at one minute intervals, in the diseased eye daily. Dionin constitutes

a powerful stimulant, a lymphagogue, and increases the phagocytic action.

Subconjunctival injections of Wright's saline solution, used from time to time during the treatment, are most useful.

Conclusion

After careful and controlled observations, we have come to the conclusion that tuberculin ought to be more frequently used in practice. Many eyes will be saved which formerly would have been lost, or the value of which would have been largely reduced.

Carefully tested and manipulated, risks of accidents with tuberculin are negligible; the results will be most gratifying, first in confirming a doubtful diagnosis, and, later, in ameliorating or altogether curing these serious and rebellious diseases.

I feel most grateful to Drs. C. G. Russ Wood and F. A. Anderson, who allowed me to collect their own cases, and to add those to the ones I treated myself during my stay at the Eye, Ear, and Throat Hospital at Shrewsbury as temporary assistant surgeon.

ANNOTATIONS

A National Ophthalmological Advisory Committee

Readers will recall the fact that upon more than one occasion we have urged the necessity of forming a National Ophthalmological Advisory Committee, to which all problems having an ophthalmological bearing arising in any Government Department, both during and after the war, should be referred. On the last occasion (January, 1918, p. 48) on which we referred to the subject, it was suggested that the Ophthalmological Society of the United Kingdom and the Section of Ophthalmology of the Royal Society of Medicine should combine forces, hold a meeting during the congress of the former Society in May, and "appoint a committee of ten or twelve members to act as a consultative body, and to watch over the public interests of ophthalmology and of ophthalmic surgeons." The suggestion has been taken up, and the letter printed below, signed by the past and present Presidents of the Society and the Section, calls a meeting for the purpose. It will be sent to the members of the Society and the Section, and we feel confident that the proposal which it embodies will be carried without a dissentient voice.

DEAR SIR,

From time to time, Government departments and other public bodies have had to deal with matters of ophthalmological interest