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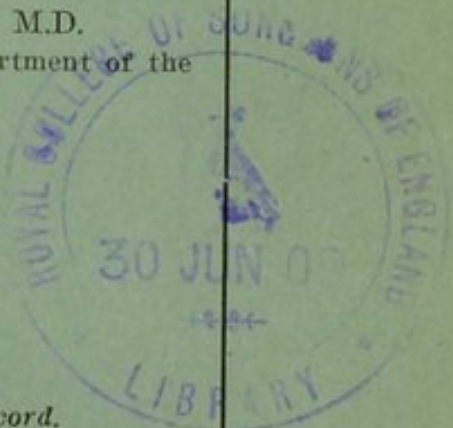
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HANFORD MCKEE, B.A., M.D.

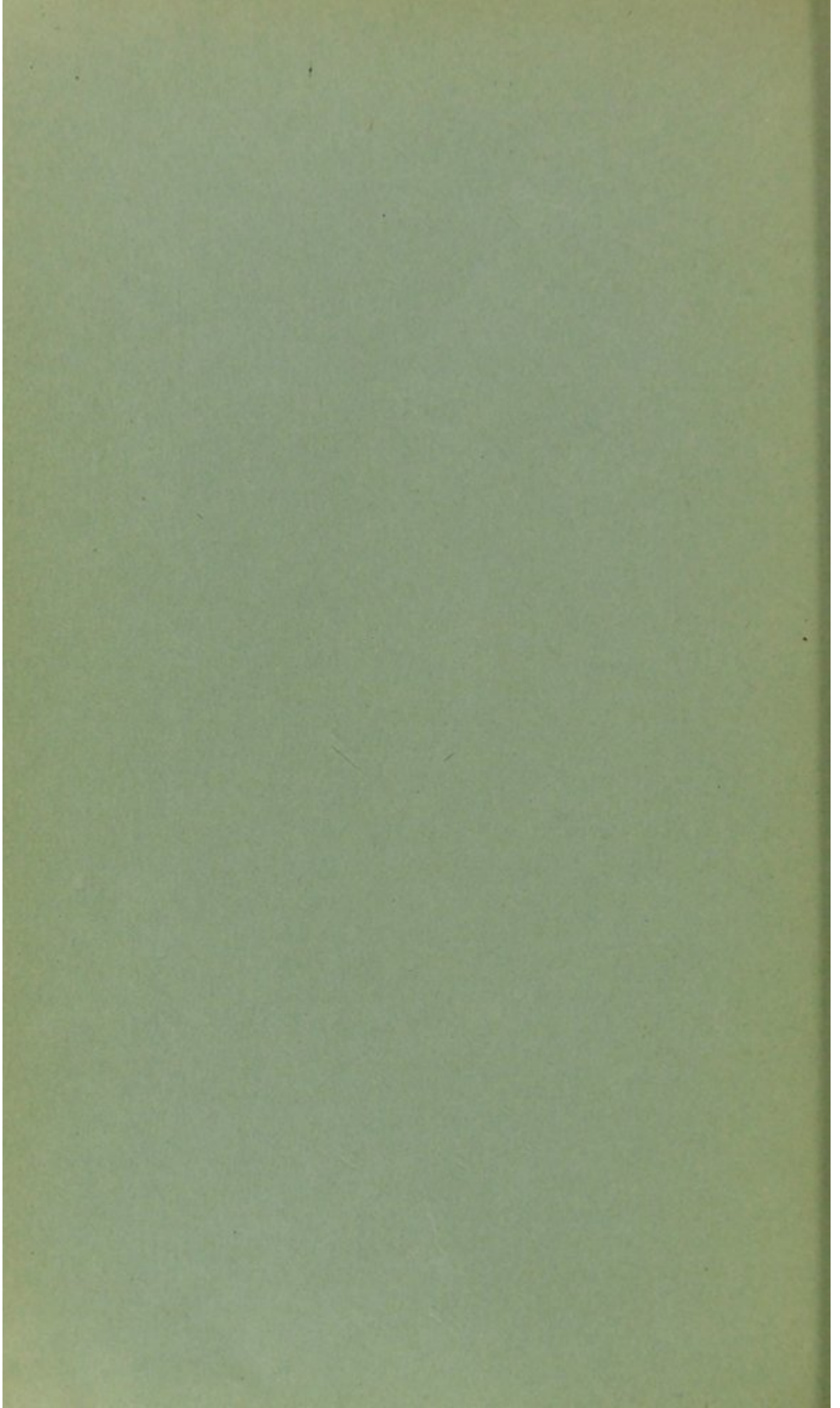
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MONTREAL, CANADA.

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ULCERATION OF THE CORNEA FROM THE DIPLO-
BACILLUS OF MORAX-AXENFELD.

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MONTREAL, CANADA.

Diseases of the cornea form one of the most important chapters in ophthalmology, and ulcerations of the cornea one of the most important parts of diseases of the cornea. Infection of corneal tissue may be either exogenous or endogenous, but probably in all ulcerative processes pathogenic organisms play an important rôle. The organisms which have been most responsible for destructive processes in the cornea are the gonococcus, pneumococcus, streptococcus, zur Nedden's bacillus, bacillus pyocyaneus, bacillus ozena. The destructive ability of these organisms when once allowed access to an abraded cornea is only too well known.

Of late a new factor in ulcerative processes has appeared. One of the best known diseases of the conjunctival sac to-day is diplobacillary conjunctivitis. It is now known that a very important complication of this disease may be ulceration of the cornea.

From the first writings on diplobacillary conjunctivitis it has been admitted that a complication very liable to occur was ulceration of the cornea; the ulceration, however, was always of the superficial type, generally at the corneo-sclerotic margin and the proportion of cases was small. That the diplobacillus might be responsible for ulcers of the cornea as severe in type as the *ulcus serpens* from pneumococcus infection has not until of late been recognized.

In 1897 zur Nedden described 23 cases of ulceration of the cornea complicating diplobacillary conjunctivitis. In the same year Uthoff and Axenfeld described a case, and Peters saw five cases

where diplobacilli were found. In 1898 Gifford reported a case of hypopion keratitis with the same etiologic factor. In 1899 Sweet described two cases complicated by ulceration of the cornea. In 1900 Petit described three cases of severe hypopion keratitis where the diplobacillus was the etiologic factor; also Hoffman, Pflüger, Biette have reported cases. In 1902 Schmidt described his findings among 193 cases of conjunctivitis. Among these he saw four cases of deep ulceration of the cornea and from two cases of *ulcus serpens* he isolated both pneumococci and diplobacilli; also in six cases of more or less variance in severity he found only the diplobacilli.

Paul, in the Breslau clinic, had an opportunity of seeing a large number of cases of diplobacillary conjunctivitis. Among these cases he examined twenty-six cases of ulceration of the cornea set up by the diplobacillus. This work was important because, while some of his cases were of the ordinary superficial type, others were so similar clinically to the *ulcus serpens* from pneumococcus infection that only the bacteriological examination differentiated them.

Later Erdmann, from the Rostock clinic, reported thirty cases of diplobacillary conjunctivitis complicated by ulceration of the cornea. Among his cases, too, was seen the form resembling *ulcus serpens*.

In January, 1906, Hanford McKee, before the Montreal Medico-Chirurgical Society, exhibited a case of *ulcus serpens* from diplobacillary infection. Only this past January has Agricola, from the Freiburg clinic, reported a series of cases of ulceration of the cornea from the diplobacillus.

In the last hundred cases of diplobacillary conjunctivitis seen here I have seen seven cases of ulceration of the cornea complicating the conjunctival disease. These cases show so well the different qualities of ulceration of the cornea by the diplobacillus that I shall describe some of them.

CASE 1.—On July 2, 1905, an elderly man entered the Montreal General Hospital complaining that six days previously he had struck his eye with a twig of a tree, but at the time had paid no attention to it. The day following his eye was painful, so he consulted a local physician, who treated him for five days and then sent him to Montreal. His condition upon entry was as follows:

Right Eye.—Central third of the cornea deeply ulcerated, edges infiltrated; the only part of the cornea clear is a small area above. The anterior chamber is about half full of pus, iris dull, pupil dilated, conjunctival sac shows profuse grayish discharge. The ulcer so resembled the serpiginous type due to pneumococcus that the usual treatment of cauterizing and the application of antiseptics was proceeded with. Despite this treatment the ulcer continued to spread. Twenty-four hours later I saw this case and made a bacteriological examination; diplobacilli in hundreds were found from the prepared slide from the surface of the ulcer, while the conjunctival sac provided cocci which were shown to be *Staphylococcus pyogenes aureus*. That day he was put on instillations of zinc sulphate, the eye quieted down and the ulceration healed rapidly.

CASE 2.—G. H. B., aged 50 years, a teamster, came to the Out-patient Department of the Montreal General Hospital Jan. 17, 1906, and complained that for two weeks his left eye had been "sore" and that during the last two days the eye had been swollen and very painful. No history here of trauma, no sign of tear sac trouble. The condition of the left eye was as follows: Marked blepharo-conjunctivitis, edema of the bulbar conjunctiva; the surface of the cornea over its central third showed deep ulceration with a large hypopion, iris was dull, severe chemosis, pupil contracted, vision = Pl., T. = N. The patient had had "sore" eyes all his life; the edges of his lids were always red, and his eyes generally watery. A smear was made from the surface of the ulcer and from the conjunctival sac, and tubes of serum and agar were inoculated. From the surface of the ulcer diplobacilli were found and were the only organisms seen. From the conjunctival sac the diplobacilli were found associated with the bacillus xerosis and the *Staphylococcus pyogenes albus*. The eye was immediately irrigated with a solution of the sulphate of zinc, one grain to the ounce. Drops of scopolamin H. Br. were instilled and the patient sent to the ward. The treatment he received there was rest in bed, instillation of sulphate of zinc, $\frac{1}{4}$ gr. to the ounce, scopolamin H. Br. and frequent irrigations of the conjunctival sac with warm boracic solution. The patient made rapid progress. The chemosis disappeared, the ulceration healed and the patient left the hospital with a very useful eye. Vision equal to $\frac{2}{3}$ normal.

CASE 3.—Adult female referred to me in February last. The history was that she had a foreign body removed from the left cornea three days previously, but her eye was still “sore and painful.” The condition of the left eye was as follows: In the lower outer quadrant of the left cornea was seen a small round ulcer; the cornea about ulcer was infiltrated, the iris was dull, pus in the anterior chamber covered the lower third of the iris. Photophobia was marked and the pain severe. With a keratome I removed a small portion of the pus from the surface of the ulcer and examined it. Diplobacilli were everywhere seen; diplobacilli were also obtained from each conjunctival sac. The eye was immediately irrigated with a solution of zinc, $\frac{1}{4}$ gr. to the ounce. Twenty-four hours later there was marked improvement, the eye was much quieter, pain and photophobia less. The eye continued to improve, and at the end of a week the ulcer was completely healed and the eye well. Vision equal N. The patient was cautioned to continue with the drops for at least three weeks.

CASE 4.—A girl of 7 years with diplobacillary conjunctivitis. In the center of the right cornea was seen a small ulcer, photophobia marked. Patient was put on instillations of zinc and within a week the corneal condition had completely cleared up.

CASES 5, 6 and 7 were very similar, all adults, laborers, each had a diplobacillary conjunctivitis and had been struck on the cornea with a foreign substance. Ulceration of the cornea followed, but in each case the ulcers cleared up quickly under zinc sulphate.

In all these cases the same technique was followed. First the ulcerated surface was stained with solution of fluorescein, then with a keratome some of the pus from the surface of the ulcer was removed, tubes of serum and agar were inoculated and smear preparations were made. In all these cases the factor was the diplobacillus of Morax-Axenfeld. These cases offer many points of interest. Cases 1 and 2 were severe serpiginous ulcers of the cornea. Case 1 did not improve even after the cornea had been cauterized and antiseptics used, and only after the instillation of a weak solution of the sulphate of zinc did the eye show any sign of improvement. Case 2 was a splendid result obtained by very simple treatment.

Cases 3, 5, 6 and 7 show what diplobacilli, and probably many

other organisms as well, will do if allowed entrance into the corneal tissue.

Case 4 is of interest because diplobacillary conjunctivitis is not common among children, and ulceration of the cornea less so. These cases were all treated by instillation of drops of the sulphate of zinc, $\frac{1}{4}$ gr. to the ounce, four or five times daily; between times the surface of the cornea and the conjunctival sac were flushed with warm boracic solution and the solution of the sulphate of zinc. At night a little bland ointment, generally boracic ointment, x gr. to the ounce, was smeared along the edges of the lids. When necessary to dilate the pupil a solution of scopolamin H. Br. was used.

The "zinc therapy" differs in degree in different clinics. Agricola, in his recent paper, describes the routine zinc therapy in Axenfeld's clinic. To instil ten times daily and oftener one-half per cent. zinc sulphate solution freely into the lower conjunctival sac and over the surface of the cornea for one-half to one minute, then five times daily for twenty minutes' irrigation with a 3 $\frac{0}{00}$ solution. Between times and for the night 15 per cent. zinc ichthyol ointment (Peters) on the conjunctival sac and on the lids, also for the severe cases mydriatics and subconjunctival injections. With this treatment the eye generally after 36-48 hours, often after 24 hours, showed marked improvement. In none of his cases, and the majority belonged to the severe type, had zinc therapy failed. I have never found it necessary to push the use of zinc to this extent, and believe the instillation of drops of a weaker solution than one-half per cent. is desirable, not only in ulcerative conditions of the cornea, but in conjunctivitis cases as well. My experience has been that one-half per cent. solution of zinc sulphate is too painful.

The zinc therapy may vary in different clinics, but the value of the sulphate of zinc as a therapeutic measure in diplobacillary infections can not be gainsaid.

The widening of bacteriologic methods in ophthalmology and its practical value is in no better way shown than by a study of ulcerative conditions of the cornea. It is essential, especially among adult patients, to treat energetically from the very beginning ulcerative processes of the cornea. The speed with which ulcers of the ser-piginous type develop is well known; whether the organism present

be pneumococcus, streptococcus or diplobacillus, destruction of corneal tissue takes place all too soon. But of inestimable value as regards treatment and as regards prognosis is it to find out at the beginning what organism you have to deal with so you may act accordingly. Much stress has been put on the minute descriptions of these ulcers. It seems to me of no great importance whether one side of your ulcer is progressing (pneumococcus) or whether the whole border of your ulcerated surface has a yellowish appearance (streptococcus), and certainly of less importance whether your ulcer is square, round, oblong or crescent-shaped. Ulcers of the cornea of the serpiginous type may be set up by either the pneumococcus, streptococcus or diplobacillus; clinically the ulcers may present identically the same picture, but in the light of our present knowledge, if we wish to treat and prognose with some degree of intelligence, how important it is to find out which of these or what other factor we may have to deal with.

The advantage of knowing whether you are dealing with the pneumococcus or the diplobacillus is easily understood. The therapeutic measures necessary to overcome either are very different from those necessary in the other. In pneumococcus infection, especially of the cornea, we have an exceedingly virulent organism to deal with. In diplobacillary infection, either of the conjunctival sac or the cornea, we have a specific in the sulphate of zinc.

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