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A CASE OF PANOPHTHALMITIS, CAUSED BY THE BACILLUS COLI COMMUNIS.

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G. W., aged six years, while drinking at a pump was struck by a companion across the left eye with a piece of wire. He complained of pain, which lasted a few minutes. That night he awoke with violent pain in the injured eye. The next afternoon, twenty-four hours after the injury, he came to the Presbyterian Eye and Ear Hospital. The condition of the eye was as follows: Penetrating wound of the cornea, extending entirely across the lower border. This wound passed in through the iris and into the ciliary border of the latter. Intense pericorneal injection, contracted pupil, with shallow anterior chamber.

Atropia was ordered to be instilled every four hours, and a compress bandage was applied. The next day the cornea was infiltrated all along the edges of the wound, and in addition to this, hypopyon was present. No light perception. Eyeball sensitive to touch. The pupil had showed no response to the atropia. Traumatic irido-cyclitis. This condition became progressively worse; panophthalmitis in four days. On the fifth day the eye was enucleated by Dr. Chisolm. I carried it immediately to the Pathological Laboratory of the Johns Hopkins University, where it was at once submitted to a careful bacteriological examination. The surface of an area including a part of the cornea and adjacent sclera was thoroughly burnt by means of a red-hot knife-blade. Through this sterilized area a small opening was made with a hot scalpel, and through the opening was thrust a sterilized platinum oese. With the purulent material withdrawn in this way from the aqueous and vitreous chambers, as well as from the inflamed tissues of the eye, agar and gelatin roll cultures and slanting agar cultures were made. Cover-slip preparations were made. An inoculation was made at the same time into the anterior chamber of a rabbit's eye, into which a small opening was made with a sterilized cataract needle through the cornea, the material for the inoculation consisting of that withdrawn with a platinum needle from the vitreous. The eye was then further opened with a sterilized knife and placed in alcohol for further histological and bacteriological examination. The agar tubes were placed in a thermostat at 36° C., the gelatin at 20° C.

After twenty-four hours the agar cultures had developed, showing a large number of grayish-white colonies of a short oval bacillus unmixing with any other variety of colony or bacillus. The growth on the slanting agar was diffuse after forty-eight hours. The gelatin roll cultures



showed good growth. The roll made directly from the eye was crowded with small gray colonies, which appeared to be a pure culture of the same bacillus already observed in the agar tubes. No liquefying or other contaminating colonies were present. The second dilution showed larger pale, gray, flat colonies having irregular contours. From single colonies inoculations were made into various culture media, and the bacillus was studied in all its properties for purposes of identification.

The fully developed surface colonies on nutrient gelatin appear to the naked eye as pale-grayish colonies with bluish translucence, often iridescent by oblique illumination, thin, flat, spread out, with notched irregular contours. They attain a size of 5 to 10 mm., and when far apart may grow even larger. Under a low magnifying power they may or may not show a central darker dot. The rest of the colony is finely granular, often nearly or quite homogeneous at the pale, irregular margin, grayish or pale yellow according to thickness, and often presenting markings in the form of irregular wavy lines, sometimes comparable to the lines representing mountains on a map. The deep colonies are round or oval, yellow or brownish, granular. The gelatin is not liquefied.

The agar colonies resemble those in gelatin. The growth in bouillon is a diffuse cloud, settling later as a sediment. Milk becomes somewhat thickened in twenty-four to forty-eight hours at body temperature, and in two or three days is firmly coagulated. The blue color of litmus milk becomes pink. On potato the growth is abundant, dirty grayish or pale brown, with some gas-formation.

The bacillus in eighteen to twenty-four hours agar cultures shows motility, but some only of the bacilli are motile, others do not move. After two to three days there may be no motile bacilli. In sugar (glucose) bouillon in Einhorn bulbs, gas is produced measuring 2 to 3 ctm. on the scale. Gas is also formed in agar to which glucose has been added. The bacilli, therefore, ferments both glucose and lactose. The bacillus is a short oval bacillus varying somewhat in length, but averaging but 2 to 3 μ . It is rather plump. It is decolorized by Gram's stain, but stain readily with the ordinary aniline dyes. The characters described identify this bacillus as the bacillus coli communis or at least as a member of the group of bacilli included under this name. It was cultivated and studied side by side with a culture of a colon bacillus obtained from healthy feces, and was found to correspond in all morphological and cultural characters to the latter.

Microscopical sections through the hardened eye showed an extensive accumulation of polynuclear leucocytes in the vitreous and infiltration of the choroid and iris with the same cells. Sections stained with Löffler's methylene-blue and with aqueous solutions of gentian-violet showed in the purulent exudate, in considerable numbers, short oval bacilli, often in small clumps, and apparently identical with those observed in the cultures. They were mostly, if not entirely, extra-cellular in situation. No cocci or other species of organism could be detected.

The rabbit's eye which was inoculated directly with a small quantity of purulent exudate from the fresh enucleated eye, showed at the end of twenty-four hours opaque infiltration of the cornea extending a considerable distance from the inoculation wound, some opaque pus on the anterior chamber, hyperemia and infiltration of the iris, with irregularity of the pupil on the side next to the inoculation, and intense conjunctivitis.

The next day the inflammation reached its acme; the pupil was entirely bridged over with a filmy opaque exudation, and there was much pus in the anterior chamber. The opacity of the cornea had extended. Cover-slip preparations from the exudate showed in large numbers and in pure culture the colon bacilli.

In the course of three weeks the inflammation cleared up, leaving a dense opacity of the cornea near the site of inoculation. Several inoculations were subsequently made in rabbits' and dogs' eyes with pure cultures of the bacillus obtained from the enucleated eye of the boy. They were made by carrying into the anterior chamber through a small opening made with a sterilized instrument at the sclero-corneal edge a small quantity of the culture on a platinum needle. In every instance when the inoculation was made into the anterior chamber there resulted a severe conjunctivitis, keratitis, hypopyon, and irido-cyclitis such as has been described, with subsequent subsidence of the inflammation, leaving only partial, often slight, opacity of a part of the cornea. It is interesting to note how rapidly such intense inflammations subside in the eyes of rabbits and dogs, whereas a similar condition in the human eye would ultimately result in loss of function in the majority of cases. When, however, the inoculation was made into the vitreous destructive panophthalmitis resulted.

I injected two drops of a thin suspension in physiological salt solution of a twenty-four hour agar culture of the bacillus into the vitreous humor of a rabbit by means of a sterilized hypodermic syringe. I made the injection at a point about midway between the papilla and posterior surface of the lens. The primary effect of this injection was simply a slight disturbance in the transparency of the vitreous in its upper part as discerned with the ophthalmoscope. After twenty-four hours the media were so cloudy that the fundus could not be seen. After forty-eight hours the pupil was blocked up with a thick yellowish white exudate, and the anterior chamber was half-full of pus. Chemosis and great injection of the conjunctiva were present. There were all the signs of acute panophthalmitis. The eye subsequently underwent slow degeneration and atrophy.

It is evident from these experiments that the colon bacillus isolated from the enucleated eye is possessed of marked pathogenic power, and is capable of setting up purulent inflammation of the eye, such as was observed in the case of the boy. Inasmuch as this bacillus was present in pure culture, we feel justified, in the light of the bacteriological examination and of our experiments, in regarding it as the specific cause of the inflammation in the boy's eye.

Three ways suggest themselves as possible explanations of the mode of entrance of this bacillus into the eye: 1. With the foreign body. 2. Later, into the wound. 3. By the circulation. As regards the last explanation, it is to be said that the colon bacillus has the power of entering the circulation, and of being carried to distant organs, in case of some lesion of the intestinal mucous membrane. In the present instance the bacillus might find a *locus minoris resistentiæ* in the injured eye. But there was no evidence of any lesion of the intestine, and we regard

this explanation as very improbable. We consider, therefore, that the bacillus got into the eye in one of the first two ways mentioned.

The colon bacillus is a normal inhabitant of the intestine, making up no small part of the feces. It is evident that it can be widely distributed outside of the body, and it has been found in water and in the ground, especially under circumstances when these could become contaminated with intestinal discharges.

The bacillus coli communis was first described fully by Escherich, in 1885, who regarded it as capable of causing intoxication by its products, but not as an infectious organism. The first observation suggesting that it might possess infectious properties was made by Tavel,¹ in 1889. The next observation was made by Welch,² in 1890.

Welch was the first to demonstrate that this bacillus is a common invader of the body in cases with lesions of the intestines. This interesting bacillus has now been found by many observers in a variety of affections, the most common being peritonitis, angiocholitis, and cholecystitis. It appears to vary very much in virulence and pathogenic power. The case reported in this paper is the first one, to my knowledge, in which this organism has been found in affections of the eye, and it therefore has seemed worthy of record. And here let me thank Professor Welch, Director of the Pathological Laboratory, for the interest he has taken in these experiments and for the many helpful suggestions he has made to me while preparing this report.

¹ Correspondenzbl. f. Schweizer Aerzte, 1889, No. 3.

² The Medical News, 1890, vol. i. p. 566. Ibid., 1891, vol. ii. p. 669. Also, Bulletin of the Johns Hopkins Hospital, July, 1891, and Trans. of the Cong. of Amer. Phys. and Surg., 1891 vol. ii.

