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OBSERVATIONS ON RING-INFILTRATION OF THE CORNEA.

BY E. TREACHER COLLINS, F.R.C.S.ENG.

THE condition which sometimes follows perforating wounds of the cornea, and which may be termed ring-infiltration or ring abscess of it, is one with which probably all ophthalmic surgeons are familiar, but which has received scarcely any mention in text-books on diseases of the eye.

I was first led to an examination of the cases and specimens of which I give the details in this paper, by the interesting theory of the pathogenesis of this affection, given by Professor Leber in his Bowman Lecture.* I was exceedingly sorry to find that instead of supporting it they offer serious objections to its acceptance. Though I have no new suggestion to make as to the singular distribution of the inflammatory products, I think these cases, and a short description of the affection based on them, is worthy of publication, more especially as so little is to be found on the subject in ophthalmic literature. Briefly, the explanation offered by Leber for ring infiltration of the cornea is as follows:—He considers that when microbes are inoculated into the cornea, their action is not limited to the small area which they occupy, but that a kind of distant action takes place, due to the diffusion of irritating substances.

* *Trans. Ophth. Soc.*, vol. xii.

In this way, what he terms a microbic area is formed around the seat of the wound. White blood corpuscles migrate from the vessels at the corneal margin and make their way towards the microbic area, without, however, quite reaching it, as it offers a resistance to their further advance. Thus a ring of infiltration is formed, the changes in the microbic area itself being simply necrotic in character. It follows that if this theory be true, we ought always to find the wound situated nearly in the centre of the ring of infiltration—as indeed it was in the third of the four cases recorded in this paper; in this

FIG. 1.

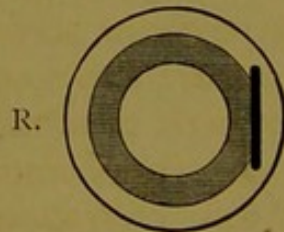


FIG. 2.

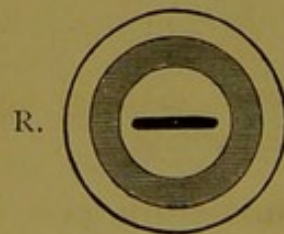
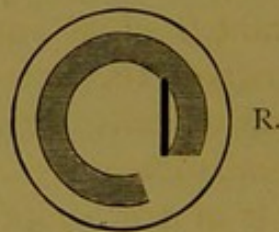


FIG. 3.

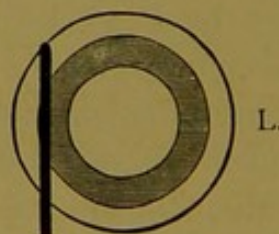


FIG. 4.

there was a small transverse wound in the centre of the cornea, with a nearly clear area around it, the ring of yellow infiltration being 1 mm. distant from the sclero-corneal margin. In the three other cases, however, the wound was not in the centre of the ring. In Cases 1 and 4 it was outside it, and in Case 3 close to its inner margin. The relation of the wound to the ring of infiltration in these four cases is well shown in the accompanying diagrams.

Ring infiltration of the cornea, so far as these four cases indicate, seems to be an affection which follows perforating septic wounds of either its central or peripheral portions. Whatsoever the locality of the wound, the ring of infiltration occupies precisely the same position, its outer edge being 1 mm. distant from the corneal margin. The ring forms very rapidly after the infliction of the wound; in Case 2, in twenty-four hours it was all but complete. In Case 3, nine days after the injury, there was ulceration commencing in the ring. It is accompanied by pus in the anterior chamber. Microscopically the cell accumulation between the laminae of the cornea, is seen to be densest at a position almost equi-distant from its anterior and posterior surfaces, or slightly nearer the anterior. There are also sometimes collections of cells between Descemet's membrane and the corneal substance. The area of cornea contained in the ring is at first quite free from any infiltration; later a general diffuse cell increase throughout the whole cornea is observed.

CASE I.—*Wound on inner side of Cornea. Excision eight days later. Complete ring infiltration.*

Charlotte E., aged 50, came under the care of Mr. Nettleship at the Moorfields Hospital on August 25, 1888. Four days previously she had had a wound of the right eye which was excised on August 29. Its condition at that time was described as follows:—The ocular conjunctiva is very œdematous. In the inner third of the cornea is a wound which extends vertically across it, but does not reach quite up to the sclero-corneal margin, either above or below (fig. 1). There is a ring of yellow infiltration in the substance of the cornea which is situated about 1 mm. distant from its margin, and is about 2 mm. wide in its broadest part. There is a large mass of pus in the anterior chamber, and the pupil is irregular.

Pathological Examination.—The yellow infiltration of the cornea is seen to be more in the anterior layers than in the deeper parts of it. A yellow mass fills the lower two-thirds of the anterior chamber. The iris and lens are *in situ*. The retina is thickened, and the optic disc swollen.

Microscopical Appearances.—There is slight diffuse round cell infiltration throughout the whole cornea, but there are two areas in the sections where it is much more intense than elsewhere. These correspond to the two sides of the ring described in the clinical notes. One of these areas of infiltration commences on the inner side of the wound. The layers of fibrous tissue of the cornea immediately beneath the epithelium are not the most involved, but those about the middle of its thickness. There is some accumulation of cells between Descemet's membrane and the fibrous tissue. Between the lips of the wound is a thin layer of cells; the fibrous tissue external to it is but little infiltrated. In the anterior chamber there is a delicate network of fibrinous material supporting numerous round cells with dividing nuclei. Material presenting a similar appearance is seen in the circumlental space and in the anterior portions of the vitreous. There is slight round cell infiltration of the iris and ciliary body.

CASE II.—*Wound a little inside centre of cornea. Excision less than twenty-four hours later. Nearly complete ring of infiltration.*

Robert M., age 67, was admitted to Moorfields Hospital under Mr. Couper, on May 3, 1889. The day previously, at one p.m., his right eye had been injured by a piece of hot iron.

On examination a vertical wound was seen a little to the inner side of the centre of the cornea, 4 mm. in length. (fig. 2). Extending round the cornea, a little distance from its margin, was a nearly complete ring of yellow infiltration; the only part of the ring that was deficient was the lower and inner. There was some lymph in the anterior

chamber, and the iris was discoloured. The globe was excised the same day.

Pathological Examination.—The lens had been perforated. Situated in the vitreous is a piece of metal 7 mm. long and 1 mm. broad. There is yellow lymph about the ciliary processes, otherwise the vitreous is clear. The retina is *in situ*.

Microscopical Appearances.—There are a few round cells between the lips of the wound, and round cell infiltration of the anterior layers of the cornea on each side of it; this only extends a short distance on its inner side, but a considerable way on its outer. The maximum amount of infiltration is not immediately at the wound but a short distance to its outer side and nearly in the middle of the substance of the cornea, *i.e.*, equally distant from its anterior and posterior surfaces. Here there are large groups of round cells in the intervals between the laminae of the fibrous tissue. On the outer side of the sections of the cornea, at a corresponding distance from its periphery, is another separate patch of cell infiltration, similarly situated and nearly equal in amount. The centre of the cornea is quite free from any excess of round cells. In the anterior chamber, between the iris and lens, in the circumlental space and in the anterior portion of the vitreous, there are numerous round cells with dividing nuclei supported in a network of fibrin. The vessels of the iris and ciliary body are enlarged, and there are groups of round cells around their walls.

CASE III.—*Wound in centre of cornea. Complete ring infiltration two days later. Excision nine days after injury, then commencing ulceration.*

Thomas S., aged 48, was admitted to Moorfields Hospital under Mr. Lawford on October 15, 1891. Two days previously he was chopping firewood and a piece flew up and struck his right eye. Examination showed a transverse wound near the centre of the cornea (fig. 3), and a general yellowish haze of the whole of it. Situated 1 mm. internal to its margin was a dense ring of yellow infiltra-

tion. There was a large collection of pus in the anterior chamber. Vision was reduced to p.l. only, and the tension was increased. The following day the cornea was punctured and the hypopyon evacuated. The pus re-accumulated, the tension returned, and the eye became very painful. It was excised on October 24.

Pathological Examination.—The yellow infiltration of the cornea does not extend throughout its whole thickness. Ulceration is commencing in the ring down and in. The lens has been wounded, its substance is suppurating and protruding through the pupil in contact with the cornea. The iris is pushed forwards by the swollen lens and the angle of the anterior chamber narrowed. There is extensive suppuration in the vitreous. The retina is thickened and infiltrated, there are hæmorrhages in it, and the optic disc is swollen.

Microscopical Appearances.—The epithelium is absent from the surface of the cornea over a large area. Some of it lies between the two lips of the wound. In the fibrous tissue at the margins of the wound there is a slight amount of round celled infiltration. Throughout the substance of the cornea there is an excess of cells. There are two zones situated equally distant from the corneal margin, in which this infiltration is more intense than elsewhere. The wound is situated between these two patches, but rather nearer one than the other. The round cells are situated between the laminæ of fibrous tissue of the cornea; besides the round cells there is some granular substance which stains with logwood. The part which is most infiltrated is not situated immediately beneath the epithelium, but is rather nearer the anterior than the posterior surface of the cornea.

CASE IV.—*Wound on inner side of cornea. Excision about forty hours later. Complete ring infiltration.*

John E., aged 30, was admitted under the care of Mr. Tay to the Moorfields Hospital on March 5, 1893. The previous evening he had received a blow on his left eye,

probably from a stone which was thrown at him. At the time of excision, the day after his admission, the condition of the eye was as follows: There was a large gaping wound extending vertically across the inner half of the cornea; it passed the margin and went into the sclerotic below (fig. 4). A blood-stained suppurating mass protruded through the wound, extending from it in the form of a circle; a little distance from the margin of the cornea was a band of yellow infiltration. The centre of the cornea remained clear.

Pathological Examination.—The lens is absent. The vitreous, blood stained and infiltrated, together with the detached retina, protrudes through the wound.

Microscopical Appearances of the Cornea.—There are round cells and epithelium between the lips of the wound; in the fibrous tissue, on the inner side of it, is some dense round cell infiltration, which, in this position, is nearly evenly distributed throughout the whole thickness of the cornea. The centre of the cornea is entirely free from any infiltration. On the side opposite to the wound, a little distance from the margin, there is a second patch of cell infiltration, which is of greatest intensity about midway between Bowman's and Descemet's membranes. A little external to this patch is a considerable accumulation of cells between Descemet's membrane and the corneal substance.

THE ROD TEST WITH THE ROTARY VARIABLE PRISM.¹

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THE rod or cylinder test belongs to that most valuable class in which binocular fusion is prevented by dissimilarity of the images, which allows them to be superimposed without any tendency to fusion.

Mr. Maddox has suggested (page 39 of this volume) the employment of two or more rods placed side by side. On trying such an arrangement it will be found that it gives not a continuous line, but a series of short lines, together constituting a broken line.² This necessarily occurs because the light cannot reach the eye through the whole width of the rod. If half cylinders are employed the breaks between the short lines are lessened, but still exist.

With one side of it plane, the light can only be transmitted through a little more than 80° of the circumference of the rod. This, then, is as large a part as can be used to advantage. If such a segment of the rod be used the light will reach the nodal point of the eye from its whole width, provided it be placed at or beyond its focal distance from that nodal point.

To secure a long continuous line of light, therefore, with as thin a segment of the rod as possible, I have used one 10mm. square cut from a rod 20mm. in

¹ Abstract of a paper read before the Section on Ophthalmology of the American Medical Association, June, 1893.

² We cannot satisfy ourselves that this statement is correct. We have carefully tested Maddox's series of rods placed side by side and find that it gives a broad unbroken, though perhaps not absolutely even, line.—ED.