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(4)

OBSTETRIC INJURIES OF THE CORNEA.

BY

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It has been the fortune of the writers to meet with a considerable number of cases of obstetric injury to the eye of the new-born child, in the course of a comparatively short period of observation. In a large proportion of these the cornea has been involved in a peculiar manner which appears to be rare in localities other than Glasgow. That this localization is dependent on the frequency of rickets, with marked pelvic deformity and consequent necessity for forced delivery, has been suggested by us already.⁽¹⁾ The scarcity of reported cases and the negation of their occurrence by obstetricians and ophthalmologists practising in other centres, tends to confirm our opinion.

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In the *Transactions of the Ophthalmological Society* for the year 1902,⁽²⁾ will be found an article by one of us (Thomson) recording three cases of peculiar corneal injury during delivery, the first, so far as we are aware, which had been described in detail, and in the volume for 1903,⁽¹⁾ a more elaborate conjoint paper in which not only corneal, but various other injuries to the eye of the new-born are described, clinically and pathologically.

The series of cases goes on increasing. Most of them occur in the service of the Glasgow Maternity Hospital, an institution in which, probably, more rickety dwarfs are delivered than in any other hospital in the world.

We have now notes—some pretty complete, others incomplete—of nine cases of *corneal* injury in addition to the six already published in 1902 and 1903. We therefore think it wise, in view of the importance of the subject both to the obstetrician and to the ophthalmologist, not to wait for further cases but to publish those we have, even although there is not much to offer in the way of explanation of the mechanism of their occurrence.

To the obstetrician and to the ophthalmologist a knowledge of the possibility of corneal injury at birth is important from different standpoints. The former may find himself held responsible for the injury; the latter may be asked for a prognosis.

In our previous joint paper we dealt with obstetrical eye injuries in general; in this communication we shall deal only with corneal lesions, for, whereas pathological changes in the interior of the globe have frequently been described by others, very little has been noted upon corneal traumatism. Further, as we have already suggested, there is a great probability that the scars left by these corneal injuries at birth may be looked upon as "congenital" leucomata. This is particularly likely to happen in those cases in which all sign of corneal œdema has passed off after a period of a few weeks.

The condition described clinically by Thomson in 1902 under the name of "Traumatic Keratitis of the New-Born" is of two-fold origin and has a two-fold prognosis. This has been amply confirmed by pathological examination and by continued clinical experience. Corneal traumatism is a rare complication of assisted labour, even when only really difficult deliveries are considered. It results from pressure during a prolonged second stage, which pressure is due either to some form of obstruction in the maternal passages, to compression by forceps, or to both factors combined. We may cite a few cases in illustration.

(a) In one case œdema of the cornea was apparently caused by the maternal passages being overfilled from the simultaneous presentation of the head, arm, and cord; no instruments were used. This case illustrates the possibility of the occurrence of

injury *apart from any interference on the part of the obstetrician*, and is worth recording on that account alone. (Case G.)

(b) In the rickety pelvis with marked sacral promontory, the pressure may be severe enough to cause a cranial depression. In at least three cases (C., F., & M.) this was associated with a corneal lesion. In F. the lesion was bilateral, and one eye, that on the side corresponding to the depression, was extruded from the orbit.

(c) Again, in the case L., in which the pelvis was not known to be contracted (the confinement was in a private house), the application of forceps caused laceration of the upper lid and rupture of the posterior elastic lamina of the cornea.

It has been stated that traumatic keratitis has a two-fold origin and prognosis. This depends upon the occurrence or non-occurrence of rupture of the posterior elastic lamina. In our 1903 paper we said that three varieties of corneal change might be distinguished clinically, *viz.* :—

- (a) A diffuse opacity which is temporary,
- (b) A diffuse opacity, indeterminate in position, which is permanent.
- (c) An opacity which takes a linear form, and is permanent.

We now consider that these three forms are, so far as our experience goes, reducible to two, for on further observation (b) has always proved temporary, namely :—

- (1) A diffuse opacity which is temporary,
- (2) A permanent opacity which takes a linear form and passes vertically, obliquely, or horizontally across the whole or a part of the cornea, in a straight or curved manner or concentrically with the limbus (*see* chart). In most cases there is more than one linear opacity.

The first form occurs with comparative frequency, and is undoubtedly due to œdema. It may occur alone or in conjunction with the second form. The second form is due to rupture of the posterior elastic lamina of the cornea and the subsequent formation of fibrous tissue. It is usually associated during the first days or weeks after birth with a general corneal œdema (first form), which may cause a uniform opacity sufficiently marked to mask the appearances due to rupture of the elastic lamina.

While it is certain that the clinical appearances tally with the pathological findings, the exact cause and direction, and the amount of pressure required to produce the lesion, remain doubtful, and this uncertainty is increased in proportion to the ever increasing number of variations of the originally described linear opacity. While most of the ruptures take place approximately vertically, a certain number occur horizontally, obliquely, and so on.

Leaving out of consideration simple œdema, which results in a dotted, interstitial, corneal opacity, passing off in a few hours or days and leaving no trace behind, it is of interest to note the clinical characters of the corneal change in those severe cases in which, owing to scar tissue formation, a more or less permanent opacity results; and to enquire into the pathological findings. We say purposely, "more or less permanent," because we really do not yet know how permanent the opacity is.

Of the cases already published we shall give full details of one, and summarize the remainder. The new cases we shall treat in a similar way, but a little more fully. In all there are fifteen cases in which a linear opacity occurred (or, in the case of still-born children, would have occurred, as shown by the pathological examination). In order that a general idea may be obtained of the clinical course of the corneal change in a typical case, Cases F and J. in this paper, and Case I. in the *Transactions of the Ophthalmological Society*, 1902 (which in the present paper is only summarized as Case B), may be read; for the pathological findings Case A is complete.

CASE A. (Case I. Thomson and Buchanan. *Transactions of the Ophthalmological Society*, 1903.)

Obstetric History.—Nineteen year old primipara, true conjugate, $3\frac{1}{2}$ inches. First and second stages, 24 hours. Child, female, $7\frac{3}{4}$ lbs., could not be got to breathe. Very difficult forceps delivery, vertex presentation. One blade of forceps applied over outer angle of right orbit.

Ophthalmic Account. Right Eye. Anterior chamber full of blood. Cornea very cloudy and showing vertical bands. On horizontal antero-posterior section of eyeball, after washing out the blood from the anterior chamber, there remains a layer of blood on the posterior surface of the cornea, interrupted by four clear bands close together, running approximately vertically across the cornea. These clear bands are due to the absence of the layer of blood. The widest band measures 1 mm. at its middle and tapers above and below; the outer bands are from one-half to one-quarter this width. Microscopically, the four clear bands correspond with gaps due to ruptures of the posterior elastic lamina. The principal rupture, in sections at right angles to its course, shows that the severed ends of the lamina are widely separated, and that, approximately, five layers of the cornea are also ruptured. The torn ends of the lamina are turned forwards and adhere to the corneal structure. The floor of the concavity formed by the retraction of the ruptured corneal lamellæ is smooth, because the ruptured fibres are sealed down by fibrin. There is very little disturbance of neighbouring corneal tissue. The second largest rupture shows destruction of only one corneal layer, and inversion of the ends of the posterior

elastic lamina. The other two ruptures involve the lamina only (see Plate XVII, *Transactions*, 1903).

CASE B.—(Case I. Thomson, *Transactions of the Ophthalmological Society*, 1902.)

Difficult forceps delivery. $9\frac{1}{4}$ lbs. male child. True conjugate $3\frac{1}{2}$ inches. Bruising of R. temple and upper eyelid. R.E. : Cornea hazy at birth due to flocculent opacity; loss of surface polish. Gradual disappearance of corneal haze with development of linear vertical scar. A year later this scar remained distinct.

CHART

Showing the positions of linear opacities in ten cases observed clinically. (Cases observed only pathologically are excluded.)



CASE B.



CASE C.



CASE D.



CASE F.



CASE J.



CASE K.



CASE L.



CASE M.



CASE O.



CASE P.

CASE C.—(Case II. Thomson, *ibid.*)

Very difficult forceps delivery. True conjugate $2\frac{3}{4}$ inches. Spoon-shaped depression of left frontal bone.

Both corneæ hazy at birth, right more so than left: R. cornea became very opaque all over 13 days later, while L. developed a linear vertical scar. Patient lost sight of.

CASE D.—(Case III. Thomson, *ibid.*)

Difficult forceps delivery. Pelvic measurements not known, marked sacral promontory. Grip of forceps on left temple, and right ear and angle of jaw. Linear, obliquely vertical, opacity of left cornea, first seen 5 weeks after birth.

CASE E.—(Case II. Thomson and Buchanan, *Transactions of the Ophthalmological Society*, 1903.)

Craniotomy, retroversion of lens and vitreous of right eye. Extensive rupture of posterior elastic lamina. Left eye entirely destroyed.

CASE F.—(Case V. Thomson and Buchanan, *ibid.*)

Difficult forceps delivery (symphysiotomy). True conjugate 3 inches. $8\frac{1}{2}$ lbs. child. Spoon-shaped depression over left frontal and parietal bones, left eye extruded from orbit. *Microscopically*, there was a ragged rupture of Descemet's membrane and eight layers of the cornea. R. cornea very hazy at birth. Opacity increased day by day till fourth day, when cornea appeared opaque all over. Subsequently the cornea cleared slowly from the superior nasal to the inferior temporal region. Eleven months after birth there only remained a narrow, crescentic, dense opacity at the lower temporal region of the cornea parallel with the limbus, and eighteen months after birth the opacity could hardly be detected in its position against the light iris background.

Up to this point we have dealt with cases which have already been published.

Of cases not hitherto published we have notes of nine. Seven of these were observed clinically, two came to pathological examination, and one was a stillborn child with bilateral lesions, of which the eyes, unfortunately, were not secured.

CASE G.—Mrs. B——, 31 years, 10-para. Of the nine previous labours one only called for the use of instruments. In the absence of pelvic measurements one may assume from this history that the pelvis is not contracted. The interest of this case lies in the fact that the tenth pregnancy ended fatally for the child, on account of the simultaneous presentation of the face, one arm, and a loop of the cord. The second stage lasted about thirteen hours, and terminated suddenly without instrumental or other assistance. The face of the child presented in a marked degree all the appearances usually observed after a difficult face delivery. There was an abrasion over the ramus of the right lower jaw, which the obstetrician regarded as probably due to the promontory. Both corneæ are stated to have been uniformly opaque.

The right eye was obtained for examination. It was found that there was slight evidence of inflammatory change in the cornea; Descemet's membrane was intact.

CASE H. *Obstetric History*.—Mrs. T——, primipara. C.V., 3 inches. First, second and third stages, $11\frac{1}{2}$ hours. Female

stillborn child, $9\frac{1}{2}$ lbs. Vertex presentation. Forceps delivery in Walcher position. At birth the left eye was displaced forward, and its cornea was hazy. The right eye presented a sharp vertical line almost on the corneal centre. (*Reported by Dr. Jardine.*)

Ophthalmic Account.—The right eye was obtained for examination. The posterior elastic lamina was extensively torn, one margin being coiled upon itself (as in Case E). There was no rupture of true corneal tissue.

CASE J. *Obstetric History.*—Mrs. M———, primipara. C.V., $2\frac{3}{4}$ inches. First and second stages, 23 hours. Female full-time child, $5\frac{1}{4}$ lbs. Vertex presentation. Difficult forceps delivery. Head very much moulded, no cranial depression. Marks of forceps blade on each frontal bone.

Ophthalmic Account.—Opacity of right cornea was noticed immediately after birth. The case was seen by one of us on the next day, and the following account of its progress is instructive, showing, as it does, the alterations which take place in the appearances of the cornea when observed over a long period. On the day after birth (December 28th, 1903) the right cornea presented a well-marked general opacity, on magnification seen to be made up of closely-packed dots, through which the pupil was visible. In addition, there was an appearance as if horizontally through the centre of the cornea there was a clearer area bounded by two narrow sharp lines. Above and below these lines the opacity seemed uniform. On the 29th the general opacity was more marked, the striped appearance less marked. By January 1st, 1904, the general opacity had become so great as almost to obscure the pupil even with focal illumination, and the striped appearance was entirely masked: corneal surface like ground glass.

On January 4th the general opacity was becoming less and the striping more manifest again. From this date onward the general opacity gradually cleared, leaving two horizontal bands as shown in the sketch made in April, 1904, by Dr. Ballantyne (*see plate, fig. 1*).

On November 12th, 1904, $10\frac{1}{2}$ months after birth, the now strictly linear opacities persisted right across the cornea, and, although hardly visible against the light iris background, became clearly defined on dilating the pupil.

It is worthy of note in this case that the house-surgeon was perfectly certain that both blades of the forceps were over the face.

CASE K. *Obstetric History.*—Mrs M———, primipara. C.V. normal. First and second stages 36 hours. Male child, 9 lbs. Vertex presentation. Forceps delivery. Forceps mark over left frontal bone extending down to eyebrow.

Ophthalmic Account.—Child was seen by one of us, but not until the sixth day. The left cornea then looked very slightly dull all over; two narrow curved bands ran across it from above downwards, the concavities of the curves facing one another and enclosing the pupil between them. The drawing (*see* plate, fig. 2), was made by Dr. Ballantyne twenty-three days after birth.

CASE L. *Obstetric History.*—Mrs. X—, primipara. C.V. not determined. Occipito-posterior presentation. Difficult forceps delivery.

Ophthalmic Account.—This case occurred in private practice. The child was seen on the sixth day. There was a curved wound of the right upper lid, transverse in position (*i.e.*, parallel with the lid margin), due to the rounded end of the forceps blade. There was a general opacity of the right cornea with a denser zone to the temporal side. Pupil easily visible. No sign of linear opacity. Seventeen days after birth, *i.e.* eleven days after the first observation, three short, sharply-outlined, vertical bands were noticed across the central portion of the cornea, two of them in the same vertical plane near the upper and lower limbus, as if they were the peripheral ends of a complete band, and the third a short distance to the nasal side and central, as if it were the central portion of a complete band (*see* chart). At this date there still remained some general opacity at the temporal side of the cornea.

CASE M. *Obstetric History.*—Mrs. W—, 2-para. Approximate C.V. $3\frac{1}{4}$ inches: marked sacral promontory. Second stage, $2\frac{1}{2}$ hours. Full-time child about 7 lbs. Vertex presentation. Difficult delivery, in the course of which forceps were applied and re-applied. At birth the forceps grasped the head in the bi-temporal diameter, and a fracture of the cranium was produced by the severity of the pressure. The patient was delivered at home, and although the obstetrician looked for corneal opacity he failed to find it, doubtless owing to defective illumination.

Ophthalmic Account.—Three weeks after birth, when the child was first seen by one of us, there were two incomplete linear opacities almost in the same vertical line, one stretching from the limbus above and the other from the limbus below, just to the temporal side of the middle line (*see* chart).

CASE N. *Reported by Dr. R. Jardine.*—Mrs. A., aged 26, 4-para. C.V. $3\frac{1}{8}$ inches. Second stage 5 hours (induction of premature labour). Delivery in the Walcher position with Milne-Murray's axis-traction forceps. Premature child weighed $6\frac{1}{2}$ lbs.; could not be resuscitated.

“The left eye protruded somewhat, and its cornea showed a marked hazy opacity with one fairly well marked band in the vertical axis. The cornea of the right eye had three distinct vertical bands, arranged like barrel staves, and general hazy opacity.

The pressure on the left side of the head had been caused by the promontory while that on the right side had been caused by the blade of the forceps."

It is most unfortunate that owing to extreme pressure of work at the Maternity Hospital the case was not notified to us, and, consequently, these eyes were not obtained for examination.

The following case is one the reference to which was mislaid, but has lately been found. It is interesting because of the fact that the exceptional size of the child's head was probably the main factor in the causation of the corneal rupture.

CASE O. *Obstetric History*.—Mrs. McK——, 2-para. C. V. 4 inches. First and second stages 18 hours. Male child, 7 lbs. Vertex presentation. Difficult forceps delivery in Walcher position. Deep pressure mark, due to forceps, over outer edge of right orbit. Other blade of forceps had pressed on left temple. The biparietal diameter of the head was $4\frac{1}{8}$ in.; other measurements also large.

Ophthalmic Account.—Immediately after birth it was noted by Dr. Jardine that there was blood in the anterior chamber, a general corneal haze, and a double linear opacity. The child was seen by one of us the following day. There was fluid blood in the anterior chamber, a well marked general haze, and a double linear opacity, placed vertically, the two lines being close together and extending from one limbus to the other. Subsequently the general opacity increased, then diminished, the blood gradually became absorbed, and on the tenth day the right hand streak had disappeared, leaving the left-hand one distinct and presenting two minute areas of blood-clot attached to it near its centre. One month after birth the blood had disappeared; the single band of opacity persisted.

The following case came under observation just as this communication was being completed:—

CASE P. *Obstetric History*.—Mrs. K——, primipara. C.V. $2\frac{3}{4}$ inches. Very little pelvic deformity though patient is a dwarf. Labour not very difficult; forceps delivery (Milne-Murray axis traction). Vertex presentation (occipito-anterior). Small wound over right external canthus from forceps blade; other forceps blade over left mastoid. Delivered in ordinary position (*i.e.*, not in Walcher position).

Ophthalmic History.—The obstetrician noted at birth a marked protrusion of the left eye and haziness of left cornea, and a wound at the external canthus of the right eye. He observed that the haziness of the left cornea increased for a few days, so that the pupil was seen with difficulty, and that after that it quickly cleared up. The eye, which had been proptosed at birth, had regained its normal position about the eighth day.

The child was seen by one of us twelve days after birth. The right eye was normal. The left eye was in normal position. There was no sign of conjunctival ecchymosis. The cornea presented a narrow line of opacity obliquely placed from the limbus up and out to the limbus down and in. The band was not easily seen, except with the aid of focal illumination. The cornea was otherwise clear.

The obstetrician is confident that a forceps blade was not in proximity to the left eye, which was proptosed, and also that the sacral promontory was not the cause of the corneal injury.

A study of these new cases—G, H, J, K, L, M, N, O, P—reveals one or two interesting new facts.

In case J we have seen, for the first time, the bands of corneal opacity in a horizontal position. In this case there was much moulding of the head, and the house-surgeon at the Maternity Hospital is positive that a forceps blade lay over each frontal bone. It is, unfortunately, impossible to state with any degree of certainty the exact position of each forceps blade in relation to the orbit. In case N we find, not for the first time certainly, bilateral corneal lesions. In this case, however, they were characterised by unusual symmetry. In case G the temporary corneal œdema had been produced by blocking of a normal pelvis by the head, arm, and cord of the child, altogether apart from any operative measures. If there was sufficient pressure to produce œdema in this case, it is possible that in another case of a similar kind a permanent opacity, due to corneal rupture, might be produced. The point is somewhat important from a medico-legal aspect.

Regarding the line of pressure which causes rupture in any particular direction, we are still unable to offer any definite theory. In a former communication we expressed the opinion that rupture of the posterior elastic lamina, and sometimes of the corneal tissue also, takes place in the meridian of pressure. Now, however, case L appears to upset that theory, because there the line of pressure was almost certainly horizontal, and yet the corneal scars were vertical. In a case still more recent than any described in this communication, the cornea was so pressed upon from above by the forceps blade that at birth the vertical was decidedly less than the horizontal diameter, yet a vertical rupture-opacity occurred. Severe ulceration of the upper part of the cornea was also produced.

This inability to determine the precise mechanism whereby corneal rupture is brought about may depend on insufficient knowledge of the factors in that mechanism. The particular shape of the pelvis (flat, rickety pelvis), with consequent head-moulding is almost certainly one such factor. It is conceivable that the position usually chosen for delivery (Walcher position

with legs hanging over the table), or the particular forceps employed, may be other factors. That the pressures exerted upon the child's head during forced delivery are probably very complex is illustrated by our case P, and also by another which occurred in the practice of an obstetrician of our acquaintance. He informs us that in the case of a woman with a markedly rickety pelvis, the child's eye was extruded from the orbit, on the side opposite to that which had been pressed upon by the promontory; indeed this pressure had been so severe that a cranial depression was produced on that side (the side opposite the extruded eye).

The uniformity of the clinical course of these cases is perhaps deserving of remark. In nearly every instance the progress of the corneal change is almost identical with that described in connection with the earlier cases, namely, (1) general haze with indication of striping; (2) increase of the general opacity, sometimes to an absolutely impenetrable degree, and often obscuring the striping; (3) gradual diminution of the former, which is due to œdema, and increased visibility of the latter, which is due to scar tissue. The ophthalmologist should remember that if he sees the case early the eye will probably look worse before it begins to mend, whereas if he sees it late it is probably on the mend in so far as the general opacity is concerned.

Regarding prognosis, evidence is gradually accumulating that the persistence of these corneal scars, or at any rate of their effect on vision, is very considerable. Case D, a boy now aged $3\frac{1}{2}$ years, has been recently examined. The opacity still persists, but requires focal illumination to render it visible. A girl of 12 years was seen just the other day by one of us at the out-patient department of the Glasgow Eye Infirmary. She came complaining of defective vision. Examination by the ophthalmoscope with +12D. behind the mirror showed appearances at once suggestive of birth injury. Investigation of the obstetric history clearly corroborated this. Truc's case³ may also be referred to, where a girl of 12 years had 4D. of astigmatism as the result of traumatism at birth. It is evident that there are two points of prognostic importance to be determined, namely, the permanence of visible scars, and their effect on vision. It is manifest that the opacities become indistinct in course of years, and it must be remembered that one which has become almost invisible may still give rise to much distortion of the corneal curvature and consequent astigmatism.

The last word which we would say at present is that in all probability we are very far from the end of our observations of such lesions, and of their effects on adult vision. They will be found to account for a certain proportion of cases of corneal astigmatism (especially monocular) of high

degree. It seems almost certain that in course of time we shall hear of a greater number of such corneal birth injuries and their sequelæ from Great Britain and from other countries.

Postscript.—Since the foregoing paper was completed our attention has been called to Communications by Sidler-Huguenin⁽⁴⁾ and by Sydney Stephenson⁽⁵⁾. These are of much interest in several respects.

Sidler-Huguenin has seen one case in which the linear corneal scar was horizontally placed. This position is evidently very unusual, and the author, like ourselves, finds it difficult to explain it as the result of forceps pressure on the eyeball. We observe that he has not had an opportunity of making sections of a cornea which had been injured at birth. It is somewhat remarkable that Sidler-Huguenin considers the prognosis in cases of corneal lesion to be good without reservation, and yet quotes a case in which linear opacities were visible after $3\frac{1}{2}$ years.

From the prognostic standpoint one of Stephenson's cases is most interesting. The patient was a girl of 12 years, whose birth-history presented every probability of traumatic eye lesion, and who had some faint corneal opacities and much irregular astigmatism (best corrected V. = $\frac{5}{12}$), showing that the prognosis must be quite guarded. This case, and also that of the other child of 12 years which we have mentioned as within our own experience, prove that a cornea which seems normal on casual inspection may yet, on careful examination, reveal evidences of an injury which has given rise to marked astigmatism.

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