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# OPHTHALMIC HOSPITAL REPORTS

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2nd. The contributions of all who are interested in the objects of our especial study, and of this publication, are requested by the Editor.

3rd. Contributions must be sent to the Editor not later than the second week in December, March, June, or September, respectively, if intended for the numbers of the Ophthalmic Reports for January, April, July, or October, 1860.

4th. Papers and Cases must be original, that is to say, not before made public in any way. Papers must not be addressed to those who have never before been interested in the subject; but all that concerns the eye, in health or disease, may be appropriated for the Journal. Cases ("Published Cases") must be novel, or of rare occurrence; but a single new fact or rare event in the history of any case is, however small in its bearing, of large importance.

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# Ophthalmic Hospital Reports,

and Journal of the

## Royal London Ophthalmic Hospital.

Edited by J. F. Streatfeild.

*Number* 12. *July*, 1860.

This Number being the first of a new Volume, it is a satisfaction to the Editor, in his work, looking back to so much success and anticipating yet more, to consider that, with his colleagues, he has tried the periodical issue of an English Journal of Ophthalmology; and certainly now it has been tried it shall be continued. The first Volume was made up of six quarterly parts, containing pp. 305 of original contributions: the second of five only, but with 50 pages more in it. Some recent Numbers have been therefore much larger in size than those first published, and as the papers, cases, and reports have not been of less value than they were, the better character of the Ophthalmic Reports, it may be believed, will be only improved in the third Volume now begun. At the same time it must be remarked that, as the increased size of the later Numbers has added so much to the expense of the publication, the coloured plates in the Ophthalmic Reports, however important, and the other illustrations must be fewer until many more names are added to the list of Subscribers.

Several new features are now introduced, and each of the headings, for a better arrangement, will appear in the contents as materials are afforded, thus—Various Observations, Selected Cases, Original Papers, and a Periscope of Foreign Ophthalmology. In the next Number, several cases specially investigated with regard to their minute anatomy shall be recorded; and the Periscope is now commenced with a summary translation of an interesting Paper lately published in Germany.

J. F. S.

# Selected Cases.

## Case XXXVIII.—Plastic Operation for the Formation of New Eyelids.

By Mr. Eccles.

Susan Horswill, aged 16 years, was admitted into the Plymouth Royal Eye Infirmary in May, 1859. She had been subject to epileptic fits, in one of which she fell into the fire, and burnt the integuments of the eyelids of the right eye. The result was, that on cicatrization taking place, the border of the upper lid, containing a few remaining eyelashes, was united to the integuments of the eyebrow, completely exposing the whole of the conjunctival lining of the lid. In like manner, the border of the lower lid was united to the integument of the cheek, about a line below the inferior edge of the orbit, everting the whole of its conjunctival lining. The eye was thus left completely uncovered, and the result was, that ulceration of the cornea had commenced, so that the condition of the poor girl was painful in the extreme, not only on account of the suffering produced by the constant exposure of the eye, but her appearance also was so frightful, that she was unable to obtain a situation as a servant, and was consequently a burden on others. The first point in the treatment was to endeavour to subdue the irritation of the parts involved in the cicatrices, and also of the eye itself; and this was effected by applying lint soaked in olive oil to the eye, so as to exclude the air as much as possible, and to keep the eye lubricated. She found great comfort in this application, and the irritation of the tissues having been somewhat subdued, I determined, in consultation with my colleagues, to attempt the formation of two new lids by plastic operations. On May 19th, I proceeded to form a new under lid. I first made a deep incision along what appeared to be the border of the lid, and then dissected up the conjunctiva with as much of the subjacent tissue as could be obtained, lest by reason of the thinness of the structure, any sloughing should take place. This dissection extended to about the depth of

three-quarters of an inch into the orbit. Having thus freed the conjunctiva extensively, I dissected out a portion of skin in front of the ear, of about the shape and size of the annexed diagram, and which had not been burnt, for of course it was desirable to avoid the employment of any cicatricial tissue in the new lid.

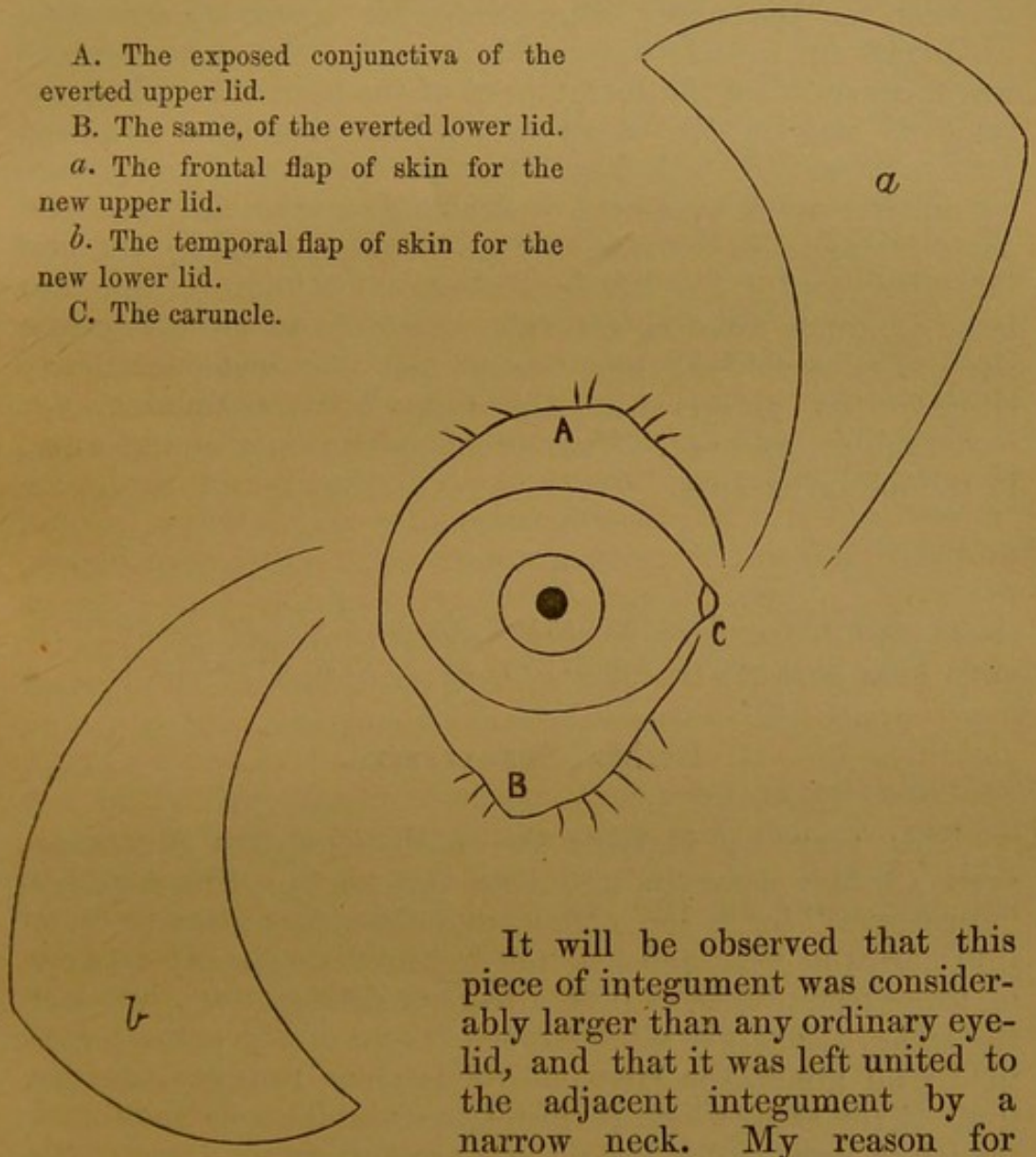
A. The exposed conjunctiva of the everted upper lid.

B. The same, of the everted lower lid.

*a*. The frontal flap of skin for the new upper lid.

*b*. The temporal flap of skin for the new lower lid.

C. The caruncle.




It will be observed that this piece of integument was considerably larger than any ordinary eyelid, and that it was left united to the adjacent integument by a narrow neck. My reason for making it of so large a size was this, that I felt certain that the tissues, which I had dissected up, would contract considerably, and so diminish the new lid which was adherent to them. This anticipation proved to be perfectly correct, for the lid was by no means too large after the lapse of a few weeks. The new lid was retained in its place by about twelve interrupted silver sutures, and it united by the first intention; indeed, so strong was the

union on the fourth day, that it resisted the congestion and traction produced by a violent epileptic fit. The ulceration of the cornea speedily healed, and the partial covering thus afforded to the eye produced so much comfort, that although the operation was a painful one, and done without chloroform, on account of the epilepsy, she determined to submit to another for the upper lid. A similar mode of operating produced an equally favourable result. The upper new lid was formed out of the integument of the forehead. The piece removed was of still larger dimensions than that required for the lower lid. (I found that the healing of the frontal wound was much expedited by drawing together its narrowest parts by metallic sutures). This lid also united by the first intention, and I had the gratification of finding, after the lapse of a few months, that she was able to close her eye, sleep comfortably at night, and that she had obtained a situation as a servant. Certainly her appearance was remarkably improved. The second operation was performed in the following July.

## Case XXXIX.—Obliteration of the lower Lacrymal Punctum.—Its recovery by a new operation.

### By Mr. Streatfeild.

This year, on October the 15th, Christina Stevenson, aged 13, first came to me, from the north, She had had "sore eyes" for a long time, and desultory attendance at infirmaries in Scotland had not bettered them. It was one of those common cases of old neglected tinea tarsi, in which the lashes are slowly all destroyed (those of my patient were nearly all gone), the edges of the lids are rounded, and the limit of the skin (which is shiny), and the mucous membrane (which is very red) is lost: there are also some incrustations upon little ulcers of the lids' margins, the lower lid (espeally when the patient looks upwards) is not quite in apposition with the globe, and the lower punctum is everted and must be looked for (according to the relation of the parts) in the tense thin skin of the lid, which seems to have advanced inwards on the lining membrane beyond its proper limits. It is now well known that in such a case to re-establish the right course of the tears, and prevent their continued over-

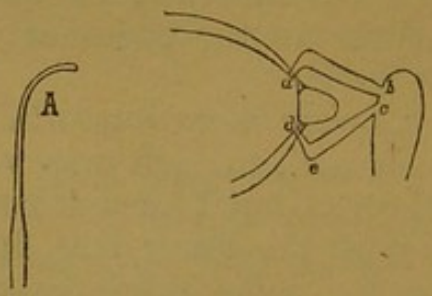
flow of the lids, with its future consequences, by slitting up the lower canaliculi is the first indication. (In the next place it is my habit to cut close with scissors, any remaining lashes, remove incrustations carefully, and touch the edge of the lid lightly with nitrate of silver, and order for the patient's use, fomentations and some simple ointment, at first). In the present instance I had slit up the left lower canaliculus, having, with much difficulty, found the punctum, and passed in by it the fine director; but I could not find any indication at all of the right lower punctum, whereabouts it had been, could be guessed, but there all the rounded lid was equally smooth and dry. Many other patients were waiting, and having tried with various probes, for some minutes, to find the punctum, with the skin damped and dry, and in all ways, I gave up the attempt and requested Dr. Bader, to endeavour to pass a probe into the punctum, he also made a long effort, and so did others, but it could not be found, and Dr. Bader, slit up for me the *upper* canaliculus of this eye which we hoped might remedy in some degree the epiphora (the constant cause of the patient's distress), and the lippitudo and slight ectropion. The largest probes, by the left lower and right upper passages, could be passed easily. No water, with Anel's syringe, by the right upper canaliculus, would pass by the lower punctum. I also cut short the few straggling lashes, and put nitrate of silver to the edges of the lids.

Next time she came, both eyes were more comfortable, and less disfigurement to the poor girl, the left was very much better and the right was improved, but I knew it could not be cured so, without patency of the lower tear duct, which, because it is the lower or for some other reason, seems to be always required. Now this was not an uncommon case, it is a very unsatisfactory state, and I began to consider of a remedy: how to reinstate the lower tear-duct when no orifice could be found for the admission of the tears. According to the anatomy of the parts I thought I might be able to pass a probe from the upper canaliculus into the lower one, the upper canaliculus was already slit up, and this would facilitate the use of the probe. I did not think that the lower canaliculus was likely to be obstructed or diseased, although the punctum was lost. The course I proposed to take with the probe was all by soft parts, which would readily yield, and if I could keep the probe in the right course throughout and avoid entangling its point in any fold of

mucous membrane, I thought I might be able either to pass the probe's point out at the place of the lower punctum, or at any rate, by feeling with the finger, detect the probe's point, and cut down upon it through the mucous membrane. I did not believe in the valves which have been supposed to exist at the extremities of the canaliculi towards the lacrymal sac, and I knew that exploratory operations (incisions made by the conjunctiva, etc.) for the discovery of the lost passage had not been successful.

On the 22nd, when she came again, with the eyelids of the two eyes improved, but unequally, I took one of Mr. Bowman's canaliculus styles,* and bent the end of the thin part into a small curve (A. in the figure) and just the point of the part curved (turned towards me) bent a very little to my right hand. I chose this canaliculus style instead of a probe, because I was sure the thin part of it would be long enough for my purpose, and the thick part I thought would be more convenient to be held in the fingers and more easily directed than a very fine probe such as I should (hoping to be able to pass it out through the lost punctum), have been obliged to select for the attempt.

I took the thick part of my instrument and holding it




A. the instrument. *a, b, c, e, d,* the direction it was made to take.

downwards close to the patient's cheek in a line with the nose, passed the point of the bent thin part into the upper canaliculus, passed it along it without moving the position of the handle, and pressed it inwards until I was sure the point must be in the sac, then I brought the handle round towards the temple, making the point of the instrument keep, as well as I could judge, in the direction of the outlet of the lower canaliculus by an abrupt turn, according to the anatomical relation of the parts (*a, b, c, d,* in the figure), to reverse the direction of the point (carefully avoiding any force, and, when

* Ophthalmic Hospital Reports, vol. i, p. 19.

the point seemed to be caught, moving it about a little) then the handle being brought over the brow of the patient, I gently pressed the point along the lower canaliculus, which with very little difficulty I found I had entered. I could feel the point of the instrument distinctly through the conjunctiva, but could not bring it out through the punctum at first,* and thought of cutting down on the point, but by bringing the handle more across the root of the nose between the eyebrows, and manipulating a little with a finger the skin of the lower lid, the point showed at the punctum, and with the pressure of a finger it emerged, then I simply divided the lower canaliculus to some extent, upon the probe, withdrew it, and ended in the regular course, by passing in at the opening I had made, along the remains of the canaliculus, and down the nasal duct, No. 6, (the largest) probe.

On the 29th, I found the patient's state rapidly improving. The escape of the tears was perfect, the sore edges of the lids were nearly healed, the natural appearance of the skin was restored and the ectropion was consequently almost cured. Her appearance and the state of the parts was, soon after this, as much improved as they could be, for her eyelashes were at first destroyed.

On November 5th, the lippitudo was less conspicuous, and so she was doing well. This day I practised again with the bent style, the "tour" I had made on the 22nd, this I did in order to learn how it should best be done. I was surprised to find that, as she sat in a chair, I could not do it at all; this I could only think was on account of the twitching of the eyelids, which she could not control (the orbicularis and tensor being in constant movement whilst I used the instrument), and it appears to have been so, for when she was put under the influence of chloroform (which on the former occasion she had taken) I, with very little difficulty, passed the bent style from the upper punctum and canaliculus, by the sac, through the lower canaliculus and punctum. In passing the bent style I found it was best to press the convexity of the curve rather upwards in traversing the upper and downwards in the lower canal, thus more probably, keeping the point of the style free from entanglement. The knowledge of when to make the sharp turn to (avoid the nasal duct and) enter the lower canaliculus, I gained by

* It then had probably reached to the end of the longer and larger division of the canaliculus, (to *e* in the figure), to the angle at which the narrower part (next the punctum) joins the wider portion of the canal.

passing the point inwards towards the nose till I felt the bone, then drawing the point a little back, I rotated it as on this point, and directed it first down and outwards, and then more outwards. I never used any force with the point of the instrument, but when the bent style has been in the way here described, passed into the lower canaliculus, of course a fold of the skin of the upper lid rests against the handle of the instrument.

In order to learn that I was able, if in any case in future it might be desirable, I afterwards on this occasion, passed my bent style once in the contrary direction to that I had been practising (also with little difficulty) that is to say from the *lower* canaliculus, by the sac, and out at the upper punctum.

## Case XL.—Accidental Trichiasis (Conjunctivitis) of two or three Lashes only of the upper Lid at the outer angle of the Lids.

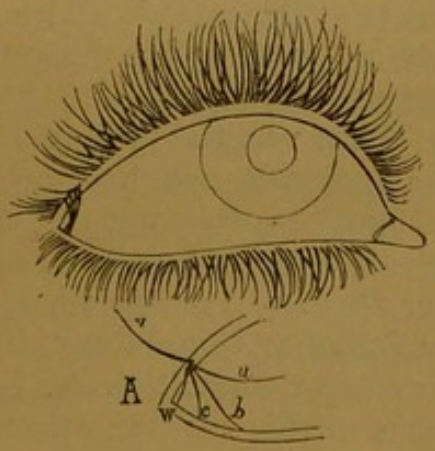
### By Mr. Streatfeild.

On the 11th of October, this year, I saw a case which I now describe in the above title as I have no precedent in other cases of the kind called by any name; none have been recorded, and indeed it is not a very important matter although it must be noteworthy, like other minor facts.

A healthy young man came to me at Moorfields, complaining of a slight "cold" in his left eye only. There was some extra secretion of tears in this eye, and the ocular conjunctiva was slightly reddened, which I afterwards discovered to be so chiefly on the outer side of the cornea. As in the examination of any case of conjunctivitis, I, with two fingers, separated more the eyelids, and then found the slight inflammation of this eye which existed was kept up by the inversion beneath the lower lid, of a little bundle (three or four) of the upper lid's lashes, near the outer commissure of the eyelids (as represented in the wood-cut), brought about by them also in the first place no doubt; and these were cause and effect of which, several times, I have seen instances, when consulted for the inevitable consequence of such a state.

The inverted lashes of trichiasis, as it is understood, are turned in so by some old vice affecting their growth, and, if they can be turned out at the time, they will resume their wrong direction as soon as the force, used to replace them in their normal position, in relation to the eye, is disused; but in the few cases of which the one above quoted is an instance, the inverted lashes are so only by a mere chance, and if they are brought out, as they very easily can be, they will, left alone, remain (if not quite as they should be, because of the habit of inversion they had had), away from the eye, and will soon resume their normal direction altogether, and their natural appearance, without any tendency of their own to reinversion. Moreover the cases to which I would call attention are peculiar in the fact that this *accidental* trichiasis only affects certain of the lashes and very few of them, those namely, which are of the upper lid and next to the outer angle of either eye, or at any rate very near to this commissure. In this trichiasis, produced mechanically, the inverted lashes can never be of the thin, curly, pale sort so often seen in the common complaint, but they are strong and retain the regular size, shape, and colour of the other lashes not misdirected.

In the case I now refer to, the last of three or four of




In the diagram (A) the eye-lash V being forced downwards to *a*, *b*, *c*, finally becomes fixed under the lower lid, at W.

the kind I have seen, the inverted lashes were not quite the most external (see the wood-cut); but in the former cases of this peculiar displacement, the outermost lashes were those affected. It should be remarked that, of either lid, the lashes are largest and longest about the centre, there they stand directly forwards, but, towards either extremity of the

two rows, the lashes are smaller and shorter, and are directed not only forwards but somewhat *laterally, from the centre, either way,*) the outer ones rather outwards and *vice versa*). In any case, so many of them as are retained in this abnormal position, lie between the ocular conjunctiva and that of the lower lid, they point outwards in an exaggerated way then, and perhaps so much so as to lie exactly along the margin of the upper lid and be directed to the junction of the two lids at their outer angle, towards the temple, across, if they are not the outermost, beneath the others, remaining in the little space externally where the ocular and palpebral conjunctivæ are in constant apposition. Thus they are pretty much hidden, and if they are also of light colour they may not be very readily detected.

Generally, I have simply with the blunt end of a small probe at the outer angle of the lids, inserted between the margin of the upper lid and the inverted lashes, pushed them out and forwards, replaced them and left them in their place with those next to them, but, in the present instance, I pulled them out altogether, not that I thought they would come upon the eye again but because it seemed to me that the patient in rubbing or wiping the tears from his inflamed eye might easily get these lashes again tucked in and the habit of misdirection these few lashes had then acquired was very evident and would be probably best lost by their growth "de novo." This patient, as in the other cases, came no more to the hospital, and no doubt, the conjunctivitis was cured.

What was the probable cause of this singular inversion? The patient's eye had been inflamed several days and he had put on it poultices, had the weight of the poultice pressed some lashes in upon the eye and the lower lid closed over them? It is possible, but I rather incline to think that the inflammation followed the inversion of the lashes, that therefore the poultices he had used were applied and that the lashes in this and the other cases (in which poultices had not been, that I remember, used) have been inverted by the knuckle of the person's own hand in rubbing the eye casually. I have sometimes, in rubbing my own eye, got some of the lashes of the upper lid tucked under the margin of the lower one and then have let them replace themselves by purposely opening the eye very widely: but a patient, not considering what may occur, perhaps rubs the eye when the lids are *not quite closed*, and having pressed in upon it some

of the lashes near the outer angle, then closing the eye, as he would do instinctively, he has them caught by the opposite lid, and especially as any one, with an irritable or inflamed eye, keeps it rather closed, and never opens it very widely) those lashes that are situated where the lids are nearest together are retained. As I had not seen either of the cases before the lashes were turned in, I do not know if the eyes had been *previously* inflamed, probably not, these patients come no more to the hospital when the deviation of the lashes is corrected, and the conjunctival inflammation, which they experience, is never severe* from this, which I take to be the cause, being so slight. I suppose if the skin is thin, and the lashes long and drooping, they would be more probably kept in by the opposite lid; but those only near the outer angle, where the two lids are nearest together, would be likely to be held when the eye is opened. They have been, probably in rubbing the eye, pressed in upon it, and by chance, these outer lashes being in the same way then forced, from their outward direction, towards the centre, pass under the lower lid and resuming their inclination outwards, from the centre, so get locked in, (see wood-cut, diagram A) and thus, by taking the course *a*, *b*, *c* in the diagram, lashes too long to be passed directly under the edge of the opposite lid, even when the lids are widely opened, may get fixed in this position, and, retained by the lower lid, they are directed in the way (*from* the widest part of the palpebral aperture) least likely for them to get free; and, as in the case under consideration, these outer lashes, held down by the lower lid seem to become turned outwards much more than they naturally are, and to be directed from (the cornea) the most prominent part of the eye. The lashes of the *lower* lid would never I suppose be liable to be detained by the other, because they are short comparatively, curved more from the eye, and weaker than the upper lashes always. I have never seen the normal *lower* lashes in under the upper lid.

* The irritation of inverted lashes, in trichiasis, or of any foreign body, it should be remarked, is less, "ceteris paribus," in proportion to their distance from the centre of the rows of lashes, because in opening and shutting the eye so much less distance is traversed upon the globe, and the sclerotic conjunctiva is less sensitive and yields more to any foreign body than that upon the cornea. To avoid movement, as much as possible, it is, that a patient, with an inflamed eye, does not open it widely, and therefore I imagine we should more frequently bandage an inflamed eye than is usually done, or keep the lids closed, at any rate.

The little accident I have here detailed, as I have noted its occurrence several times in the last few years, should be well known. My remarks on the fact may be briefly summed up thus:—The lashes near to either commissure are not only directed forwards but rather towards it. Those (of the upper lid) at the outer angle (pointing outwards) being pressed in the contrary direction and forced upon the eye resume their normal (outward) direction when it is possible for them, although they are still held down by the opposite (lower) lid being over them. Detained in this abnormal position, these lashes tend rather to exaggerate their normal direction (towards the temple) than to take the (opposite) course, which would be most likely to free them.

# Original Papers.

ON THE

## DIVISION OF THE CILIARY MUSCLE IN *GLAUCOMA*.

By Mr. Hancock.

(*Received September 4th.*—Ed.)

The relation which the ciliary muscle bears to the other constituents of the eyeball, entitle it in certain diseases of this organ to a greater amount of consideration than it has hitherto received.

It is closely connected with the line of junction between the cornea and sclerotica, the choroid and iris, and receives the middle portion of the posterior elastic layer of the cornea, whilst the most anterior portion forms distinct columns, and constitutes the pillars of the iris (Bowman), or the "ligamentum iridis pectinatum," (Huck.) It is continued into the iris upon the anterior surface of which its fibres may distinctly be traced. It is closely attached to the circular sinus of Schlem, connecting the iris to this point, and constituting a bond of union between it and the ciliary processes; the retina likewise terminates in its ora serrata at the posterior edge of this muscle. The long and several of the anterior ciliary arteries pass through it, as well as many of the posterior ciliary arteries, in their passage from the choroid to the iris; whilst the choroidal veins having reached the ciliary muscle, "turn with a sharp curve along it, and uniting, form a nearly straight horizontal vessel of considerable size along its posterior edge," (Nunneley, Organs of Vision, page 168).

The ciliary nerves also run through it, ramifying freely throughout its substance.

It would thus appear that the ciliary muscle, whatever its especial functions may be, is a bond of union between every coat of the eye with the exception of the conjunctiva, the cornea, sclerotica, choroid, iris, ciliary processes, and retina, being more or less connected with it; and we may, I believe, fairly assume, that not the least in importance of its functions is, to exert an uniform action or influence over the several coats of the eye, in their adaptation to the various foci necessary to the perfection of vision.

Connecting these anatomical facts with the pathological appearances in glaucoma, I believe that anything which deprives the ciliary muscle of its natural elasticity, whether undue spasmodic action or otherwise, must exert a prejudicial influence, and tend to increase if not to perpetuate the pathological conditions observed. These conditions have been so fully described by other writers in this journal, that it is unnecessary to do more than to allude to them here.

I have elsewhere stated my disbelief in the theory that glaucoma is mainly and originally attributable to an excess of fluid within the eyeball, producing intraocular pressure; this fluid would not be poured out unless it were preceded by some derangement of function or structure; a derangement manifested in the morbid changes in the blood-vessels of the choroid and retina.

In the more advanced cases of glaucoma these vessels are found to be affected by atheromatous or fatty degeneration, whilst in the more recent instances "the capillaries of the retina are studded with small pouches, which frequently give way, and allow the blood to spread either amongst the elementary tissues of the retina, or bursting through the hyaloid membrane to form clots in the vitreous humour."

The larger vessels of the choroid become varicose, and by their pressure outwards cause absorption of the sclerotica, and produce staphylomata of this tunic of the eye.

I have so commonly found that patients labouring under glaucoma have previously suffered from rheumatism or gout; I have so frequently observed the gouty swellings on the

joints of the fingers of these patients that I have for a long time past regarded glaucoma as originating in one or other of these diseases, as being in fact another manifestation of this same pathological condition; and although in the earlier stages of such cases there may not be any appreciable change in the minute vessels of the retina and choroid, we may, I would submit, fairly infer that they are in an unhealthy condition, predisposed to further morbid change of structure, and less capable of resisting pressure, or of overcoming any interruption to the circulation of their contents, than in their more healthy state.

On the other hand, I am far from asserting that glaucoma is caused by spasm of the ciliary muscle.

What I believe is, that glaucoma is due originally to a gouty or rheumatic condition of the blood; that the muscular fibres and blood-vessels become implicated, as sooner or later do the heart and blood-vessels in these complaints; that the ciliary muscle is either as in the acute or earlier period of the disease, thrown into undue action, or as in the advanced stages of the same complaint, is converted into a state of mere atrophy, and is thus deprived of its elasticity, and that from the peculiar arrangement of the vessels of the choroid with reference to this muscle the circulation through these vessels is impeded, whilst their coats already weakened by the exciting disease, yield, form pouches, give way, or become varicose; and that the intraocular effusion takes place subsequently to, and resulting from, these morbid changes.

I have often observed, particularly in acute glaucoma, that the eyeball is elongated in its antero-posterior axis; that the cornea has become more prominent, apparently at the expense of its several diameters; and a distinct sulcus or depression has surrounded the anterior segment of the eyeball, corresponding to the situation of the ciliary muscle, whilst the vessels in its neighbourhood were extremely turgid and congested.

It was this fact which led me in the first instance to sup-

pose that the constriction at this point, from whatever cause it might arise, exerted great influence over the persistence of the disease. The mere presence of fluid within the eyeball could not *per se* account for the sclerotic staphylomata; the elongation of the eyeball in its antero-posterior axis, or the constriction behind the cornea. On the contrary, the pressure acting equally on all parts of the interior of the globular eyeball, the greater the internal pressure, or the larger the quantity of the fluid effused, the less irregularity would there be on its external surface. Neither of itself could it produce cupping of the optic papilla, pulsation of the retinal artery, aneurismal swellings of the retinal veins, or a varicose condition of the choroidal veins, etc. If the disease depended so entirely upon the presence of fluid, the operation of paracentesis, as performed in our own times by Middlemore and Desmarres, would in all probability have proved successful, and the evacuation of the fluid been followed by almost instantaneous relief to the symptoms; but this has by no means been the case after my operation, inasmuch as in several instances there was very little, if any, improvement to vision for some weeks after the operation was performed, as in the following case:—

"J. C., æt. 57, readmitted into Royal Westminster Ophthalmic Hospital, 15th February, 1860, with glaucoma of the left eye.

"Since his previous discharge from the Hospital, the right eye, on which iridectomy was performed, has been free from pain, but the sight has continued much the same, only the power of distinguishing light from darkness remaining. He has now almost completely lost the sight of the left eye, being just able to perceive light; he has occasionally some pain in it, and sees flashes of fire before it. The eyeball is hard, the pupil nearly insensible to light, the humours turbid, with some opacity of the lens, so that the retina and choroid cannot be seen. There is a distinct greenish reflection from the pupil; the cornea is not prominent, but somewhat rough on its surface, though quite transparent. The right eye has

much the same appearance; if placed opposite the light he can tell if any dark body be moved before his eye, but he cannot distinguish its form.

"17th.—Mr. Hancock divided the ciliary muscle in the left eye.

"20th.—The patient has experienced very little pain since the operation; the wound in the sclerotica has healed; the pupil is very slightly drawn towards the incision; the sight remains much the same.

"25th.—Has had a little pain in the eye and forehead, but that has now passed off; the eye has much the same appearance, and he thinks he can see a little clearer.

"27th.—Very little change in the patient's condition; though if anything his sight is clearer.

"March 1st.—To attend as an out-patient.

"23rd.—His sight is now decidedly improved; he can distinguish small objects, such as a key, pencil case, etc., and can tell how many fingers are held up before his eyes. The pupil has regained its natural shape."

Regarding the fluid therefore as playing but a subordinate part in the disease, it seemed to me that the first object to be attempted, was the improvement of the blood-vessels by removing constriction, and so relieving the circulation through them, with the view of either entirely arresting, or at all events of diminishing, the abnormal secreting action. The mere evacuation of fluid would avail but little unless at the same time the whole of the coats of the eyeball were freed from the constriction caused by the ciliary muscle already adverted to.

If a ligature be tightly passed round a limb, œdema or an abnormal collection of fluid takes place, with swelling and proportionate disturbance of function.

Relieve the constriction by division of the band, and the freedom of the circulation is restored; tension is removed by absorption of the fluid, and *pari passu* is function regained.

Here, no fluid has been lost, and yet the result is healthy action. What would be the utility of puncturation if the band were still girding?

With this object I proposed the division of the ciliary muscle, not for the sake of dividing the muscle simply, but with the intention of, at the same time, cutting through and freeing the attachment of the several parts connected with it; *e.g.* the cornea and sclerotica at their junction, the middle portion of the elastic layer of the cornea, the choroid, iris, pillars of the iris, etc.

The operation, which is very simple, and I am told by no means painful, is performed in the following manner :—

A Beer's cataract knife is introduced at the outer and lower margin of the cornea, where it joins the sclerotica. The point of the knife is pushed obliquely backwards and downwards, until the fibres of the sclerotica are divided obliquely for rather more than one-eighth of an inch; by this incision the ciliary muscle is divided, whilst if there be any fluid accumulated, it flows by the side of the knife.

The quantity of fluid varies considerably; in some instances it is great, in others scarcely appreciable. That the benefit resulting from my operation (the division of the ciliary muscle, etc.), does not depend upon the mere evacuation of fluid, is shown by the following case, which has been kept and kindly furnished to me by my friend Mr. Whitney, of Great College Street, Westminster, whose patient the young lady is, and I believe has been from her birth, and with whom I attended the case.

"Miss H. F., 26 years of age. The left eye became affected six years ago, with acute iritis. Under a mercurial treatment the inflammation subsided; but in about three or four months, after exposure to cold, relapsed. This second attack was treated with mild mercurials, combined or alternated with a variety of tonics, accompanied with constant appliances of counter-irritation. This course of treatment, which extended over a period of three years, exercised little control over the steady, obstinate progress of the disease, evinced by permanent chronic sclerotitis, contracted and irregular pupil, with progressive opacity in the capsule of the lens and lens itself, and opacity in the circumference of the

cornea. These conditions were accompanied by gradual loss and ultimately utter extinction of vision in the left eye.

"Subsequently two or three very small spots of deposit were observed on the iris of the right eye. An issue was now made in the right arm, and the little spots on the iris soon disappeared.

"This eye continued in a sound state for two years. Three months ago the patient experienced suddenly (after some exposure to cold), a sense of dimness and weakness of sight. The issue (which in consequence of much debility had been gradually permitted to heal), was immediately reopened, but without effect.

"The sclerotica soon presented a slight zone of redness, which quickly became a bright circle of inflammation around the cornea. The iris bulged forwards, the pupil becoming dilated, irregular and appearing notched on its inner margin, with a whitish, fibrinous-looking deposit at this point. The lens and its capsule appeared cloudy. Vision was now rapidly failing; nothing could be clearly seen; the power of defining objects was gone.

"Mr. Hancock having seen the eye, decided on performing his operation for dividing the ciliary muscle. He therefore operated seven weeks ago. It was distinctly observed that *no* fluid escaped from the puncture made in the eyeball.

"The eye was dressed with cold water, and the patient put to bed. In ten days the sight began to improve, with gradual subsidence of the inflammatory appearances; the pupil gradually to recover its shape, and the fibrinous-looking deposit is daily diminishing."

She can now define small print distinctly.

In performing the operation, care should be taken not to allow the incision to extend at all into the transparent cornea, as when this takes place the iris is apt to protrude through the cut, and the pupil is consequently deformed by being drawn in that direction. When, however, this does occur, it is of but little importance, inasmuch as in the large majority of cases the iris resumes its proper situation, and the pupil its natural shape; and in those cases in which the iris is not com-

pletely withdrawn from the wound, the resulting deformity of the pupil is very trifling. When performed for acute glaucoma, wherein the pain has been very intense, the relief has followed almost instantaneously; the smarting of the operation may last half an hour, or even two or three hours, but patients usually distinguish between the two, and whilst noticing the smarting, express their satisfaction at their freedom from the agony which they endured previous to the operation.

That this operation exerts a very great and very decided influence, is proved by the improvement which takes place in the physical appearances of the eye after its performance.

Dilated and fixed pupils have resumed their natural size and action; cupping of the retina and pulsation of its vessels have disappeared; the varicose and congested state of the choroidal vessels with the resulting sclerotic staphylomata have subsided, the eyeball becoming even upon its surface, and losing its abnormal hardness.

I have entered thus at length upon the peculiarities of my operation, and my reasons for proposing it, as I find that notwithstanding the explanations which I have already published, it has been stated by a recent writer, one of the chief supporters of iridectomy, that this operation is merely one of paracentesis, similar to that performed in our own times by Middlemore and Desmarres, and consequently, from the absence of originality unworthy of consideration. The operations of Middlemore and Desmarres were avowedly those of "paracentesis" in its most literal sense,—a puncture for the evacuation of fluid. My operation, on the contrary, is proposed, avowedly, not for the evacuation of fluid, but for the division and freedom of certain and particular parts. And although fluid, when present (which I have shown is not in all cases), flows by the side of the knife, it is merely a coincidence, not a primary object. In fact, from the situation in which von Graefe makes his first incision I believe that he at the same time cuts through the ciliary muscle, whence the success of his operation; and I quite expect that in process of time it will be found, that the extent of this incision may be materially diminished and the tearing away of the iris altogether dispensed with.

# PARALYTIC AFFECTIONS OF THE MUSCLES OF THE EYE.

(*Concluded.*)

By Dr. J. Soelberg Wells.

(*Received July 9th.*—Ed.)

Having finished the consideration of the different symptoms presented by the paralyses, let us now turn our attention to their causes, prognosis, and treatment; and let us also glance at the course which they may run, and at the different processes into which they may pass over or give rise to.

We sometimes meet with congenital paralytic affections of these muscles. Thus for instance, we may see *ptosis congenita*, or a more or less complete paralysis of several or all the branches of the third pair. This may be caused by intra-uterine affections, or may be due to the imperfect development of the muscles of the eye, etc. As we often find that the parents of these children have suffered from affections of the muscles of the eye (squint, etc.), it appears very probable that there must be in some families a hereditary predisposition to these lesions.

*Causes of Paralyses of the Muscles of the Eye.**

I. *Rheumatism* furnishes a large number of cases. We find that the onset of the affection may be exceedingly rapid.

* I have not included amongst the list of causes that supposed to be dependent upon reflex action. The opinion that paralysis might be owing to this was first proposed by Romberg, but has since then been strongly opposed by Hasse and others, and it seems, that however true it is that spasmodic affections are very frequently due to reflex actions, the same cannot be said with any amount of certainty with respect to paralytic affections.

The patient has caught a cold, or has been subjected to a draught of cold wind which has played upon his cheek, this is soon followed by pain around the orbit and masked *diplopia*, etc., as a premonitory symptom of paralysis. The palpebral branch of the *oculomotorious* is very often the seat of such a paralysis. Mackenzie mentions "a case of paralytic *ptosis* induced on both sides, in a man who walked about all day, with his hat wet from having dropped it into a river."

The patient generally complains of more or less severe pain around the orbit, also when the eye is moved. In certain directions some degree of diminution in the mobility of the eye will become apparent, and then the accompanying *diplopia* will soon let us ascertain with certainty what muscles are affected. At present the pathological changes which occur in these rheumatic paralyses have not received a satisfactory explanation, and we do not yet know exactly whether deposits or other changes take place in the substance of the muscles or nerves distributed to the affected part, or whether the fibrous tissues which invest the nervous trunk are the seat of the rheumatic inflammation. At all events the changes met with in the examination of these structures are not sufficient always to account for the amount of disturbance in the mobility of the parts; and it appears probable therefore that the presence of these deposits may be very transitory and that they may not leave behind them any appreciable lesion of the substance of the nerve or muscle.

The *prognosis* is favourable in this form of paralysis, particularly if the patient applies very soon after the invasion of the disease. It generally passes away without leaving behind any impairment in the functions of the muscles.

The *treatment* should be chiefly antiphlogistic. The patient is to be freely purged with a good dose of calomel and colocynth or jalap; an emetic is also of service and may generally be repeated with advantage, as we often find great improvement after its administration. It is also very serviceable to keep up, in a later stage of the affection, a

state of nausea by giving tartar emetic. Leeches should be applied before the ears, and blisters in the nape of the neck or behind the ears. Diaphoretics, colchicum, Dover's powder, etc., are to be administered and the Russian vapour bath may be also recommended. When the inflammatory symptoms have subsided we generally find much good resulting from the use of the intermittent galvanic current, which may at first be applied at an interval of one or two days and afterwards every day. Owing however to the fact that it cannot be applied *directly* to the muscles of the eyeball it is mostly less efficient than in paralysis of the *orbicularis palpebrarum* where its application is direct.

We must here mention the fact, that inflammation of the capsule of Tenon may give arise to a transitory paralysis of the muscles of the eye. This affection, which has sometimes been described as *myitis oculi*, is generally caused by draughts of cold air playing upon the cheek and eye. The patients complain of severe pain in and around the orbit, the *conjunctiva* is more or less injected, there is often a good deal of serous *chemosis*, slight *exophthalmos*, slight *ptosis* and a variable degree of immobility of the eyeball. The movements of the latter are painful and sluggish and accompanied by a feeling of tension in the eye. The treatment must be antiphlogistic.

II. *Causes situated within the Orbit.*

These are very numerous and we can but point out the most common and frequent amongst them. Effusion of blood into the orbit is often the very sudden cause of paralysis.

Von Graefe has reported an interesting case of paralysis which was most likely owing to this cause.* In the left eye of his patient. the *R. superior*, *R. inferior*, and *O. superior* were *completely* paralysed, the *R. internus*, *R. externus* and optic nerve partially so. The paralytic affection therefore extended simultaneously over the course of four nerves, viz., the *oculomo-*

* Graefe's Archiv, vol. i. part 1, p. 424.

*torius, abducens, trochlearis* and *opticus,* and its cause could therefore only be situated within the orbit or *cranium.* The left eye appeared a little prominent, and its sight was very much affected, for the patient could only with difficulty decipher very large print. The complete absence of any symptoms of a cerebral lesion led von Graefe at once to think it owing to some cause within the orbit, situated most likely near the posterior apertures, as the nerves lie here in such close proximity to each other. The patient did not complain of spontaneous pain, but only of a dull feeling of pressure in the depth of the orbit. Upon pressing the eyeball backwards a good deal of resistance was felt, and the patient complained at the same time of tolerably acute pain. These facts together with the absence of all inflammatory symptoms, and the sudden appearance of the affection after a very fatiguing exertion, led von Graefe to diagnose an effusion of blood into the orbit behind the eyeball, which caused a compression of the aforesaid nerves. The correctness of this diagnosis was borne out by the fact, that the symptoms very rapidly disappeared after the application of leeches, purgatives, and maintenance of strict rest of the eyes. Within two days the pain upon pressure and the prominence of the eye decreased and soon disappeared altogether. After the lapse of six days the vision was vastly improved, and at the end of a fortnight the different paralyses had been completely cured.

Amongst the other causes, situated within the orbit, by which paralyses may be produced must be mentioned, aneurisms, aneurism by *anastomosis,* tumours within the orbit, which tumours may be encysted, fatty, osseous, scirrhous, fibrous, etc. Abscess, and formation of matter in cases of inflammation of the cellular membrane of the orbit, or as a consequence of *caries,* may give rise to *exophthalmos* and implicate one or more nerves by pressure upon them.

The cases of *exophthalmos* with *struma* and affection of the heart do not generally cause any diminution in the mobility of the eyes. When the turning point of the eye is very much dislocated the lateral mobility may be somewhat impeded, which gives the patient a very fixed and staring appearance; but as von Graefe has pointed out, the decrease in the mobility is symmetrical in all directions and this serves to distinguish it from that caused by tumours, *exostosis,* etc.

The *prognosis* must depend entirely upon the nature of the cause. For if the primary affection can be removed or dispelled, as for instance in cases of effusion of blood into

the orbit, the prognosis is favourable, for complete restitution may very rapidly follow a proper course of treatment.

The *treatment* must also vary with the cause. In cases of inflammation we must prescribe antiphlogistics; in effusion of blood, leeches, purgatives, etc. In abscess or formation of matter from *caries* we must care for a proper discharge of the matter.

III. A very congested state of the blood-vessels within the orbit or at the base of the brain may exercise pressure upon one of the nerves and thus cause paralysis. Mackenzie points out the fact "that the third nerve is more obnoxious to palsy than any other of the cerebral nerves. This is perhaps owing to its position, as it emerges from the brain, between the posterior artery of the *cerebrum*, and the superior artery of the *cerebellum*. Sometimes the former vessel traverses the trunk of the nerve. Congestion then of these vessels may readily cause palsy of the nerve."

That this may in reality be the case, and that an abnormality in the distribution and position of these arteries may indeed cause a paralysis of the third is illustrated by a case of Türck; who saw a paralysis of both *oculomotorii* caused by their being compressed by small branches of the *profunda cerebri* artery, which entwined them in their meshes.

The *prognosis*. Although this may in some cases be favourable, it must in the majority remain dubious.

The *treatment* should be derivative and antiphlogistic. Purgatives should be administered, and leeches may be necessary, but we must be entirely guided by the cause and character of the congestion.

IV. *Syphilis* is undoubtedly one of the most (if not the most) frequent cause of paralytic affections of the muscles of the eye. Von Graefe, indeed, thinks that about *one-third* of these paralyses are due to it. In many cases it is almost impossible to ascertain with any precise amount of accuracy whereabouts the process which causes the paralysis is situated, and we must be content with the knowledge that the patient has suffered from venereal disease, and under the proper treatment we frequently find a very rapid recovery ensuing.

When nodes, *exostoses*, etc., are situated within the orbit or at the base of the brain, (in the latter situation they are sometimes met with just at the exit of the nerves) they may press upon the nerves and thus impede their action. *Neuroma* if situated in one of the *motor* nerves of the eye may cause an impairment of its function; but although there is every reason to believe that *neuromata* very frequently have a syphilitic origin, this is still doubted by some authorities. Two very interesting cases of syphilitic *neuroma* have been reported by Dixon in the Medical Times, (1858). A tumour was found in each case, implicating the third nerve and the membranes around the internal carotid and basilar arteries. The patients had suffered from tertiary syphilis. These cases are particularly valuable as they show a disease of the membranes co-existing with changes in the structure of the nerves themselves.

Although many observations have been made concerning paralytic and other affections in the brain in persons suffering from *syphilis* the etiological question, as Virchow has pointed out, presents here the greatest difficulties. In many of the cases which have been reported traumatic lesions had occurred prior or during the syphilitic infection, and it was therefore exceedingly difficult and doubtful to determine whether the tumours, etc., were a consequence of the injury, or owing to the syphilitic infection.

Von Graefe narrates a case of paralysis of the *oculomotorius* in a child 2 years of age who had lost the sight of the other (right) eye through *iritis syphilitica*. Upon a *post mortem* examination the left *oculomotorius* was found half as thick only as the right, and irregular, shewing thick opaquely whitish portions, alternating with interjacent attenuations; between these the nerve appeared somewhat more than normally transparent. Three or four such thickenings could be distinguished between the exit of the nerve from the brain, and its entrance into the orbit. These were seen, upon a section, to proceed from the sheath of the nerve, and microscopically the nerve elements appeared indistinct and

granular. In the left *corpus striatum* as well as in the right hemisphere, the brain was found softened, within these "foyers" of softening the substance of the brain appeared greyish-yellow, discoloured, friable and traversed by numerous fine formations of vessels and capillary apoplexies.

We sometimes meet with spots of fatty degeneration of the *neuroglia* in children suffering from hereditary syphilis. For these and other changes which may occur within the brain I must refer the reader to Professor Virchow's admirable paper upon the nature of constitutional syphilitic affections. (Archiv für path. Anat. und Physiologie, Bd. xv.)

The *prognosis* in these syphilitic paralysis may incline towards the favourable side of the scale, but must very much depend upon the seat and extent of the cause.

The *treatment* from which the greatest good is experienced is the administration of the iodide of potassium, it is surprising how rapidly these paralyses often yield to this remedy. In Germany, Zittmann's decoction is also in great favour, it most likely acts more as a powerful diaphoretic than as an antisyphilitic.

V. Causes situated at the base of the *cranium* often produce paralyses of the muscles of the eye. We may suspect the cause to be situated here when several muscles of one eye or still more of both eyes are affected. We should however be exceedingly chary of at once localizing the causes of paralytic affections at the base of the brain or within the brain itself, and should always first think of a cause situated within the orbit. If for instance a patient consults us with a paralysis of several branches of the third pair, and of the *trochlearis* in one eye, we should examine whether the cause may be within the orbit. The eye would in such a case most likely protrude somewhat, owing to the paralysis of the *recti*, but this *exophthalmos paralyticus* will disappear upon slight pressure, and the eye will easily resume its proper position in the orbit. If however any tumour, etc., is situated behind the eyeball, this will not take place and we shall feel some resistance, the patient will at the same time complain of pain

when the eye is attempted to be pressed back. If no cause is found within the orbit, we must examine whether or not some other nerves besides those of the muscles of the eye are not affected. If we find that the facial or branches of the fifth are implicated (without any disturbance of the intellectual functions) we shall be justified in attributing the paralytic affection to some cause situated at the base of the brain.

We find that the causes which have their seat at the base of the brain generally produce paralysis by means of compression of the nerves which lie in this situation. We must enumerate amongst these causes rheumatic and syphilitic *ostitis* and *periostitis, exostoses,* syphilitic *topha,* tubercular deposits, effusions of blood, etc. In cases of syphilitic *periostitis* the patients generally suffer most violent and excruciating pain during the night. It is very important for the patient that we should make the right diagnosis in the latter cases, for if we mistake it for a central apoplectic affection it might prove very injurious. Plastic exudations and tubercular deposits are frequently the cause; or also tumours at the base of the brain, these may be scirrhous, fungoid, etc., and by pressure upon the nerves produce paralysis. In these cases as well as in those caused by aneurism the progress of the paralyses is slow, the reverse is the case (and this may help to assist our diognosis) in cases of plastic exudation, (as in *meningitis*). Here indeed the extent of the paralytic affection may often furnish us with a just criterion of the intercranial lesion.

The paralytic affection increases with the growth of the cause, and is very frequently associated with a diminution of mobility in other parts of the body (paralysis of the extremities, etc). The intellectual faculties generally escape.

VI. We must now turn our attention to those causes which are situated within the brain itself. The diseases of the brain and the processes within this organ which may give rise to paralytic affections, are, however, of so important a nature, and demand so explicit a consideration, that more

than a cursory review of them would extend beyond the limits of this paper. I must, therefore, beg to refer the reader to special works upon Diseases of the Brain for the necessary information upon this very interesting subject.

When the paralysis is owing to some lesion or process within the brain, we generally find that the patient shows some derangement in his intellectual functions. His memory fails him; he experiences a difficulty in arranging his ideas, or giving utterance to them, etc. These derangements are very often transitory, and may vary in extent from a slight loss of memory, to a state bordering upon idiotcy.

*Ptosis* is not unfrequently a symptom of a central affection, whereas *lagophthalmos*, as has been before pointed out, is only exceptionally so.

Amongst the processes within the brain which furnish us with examples of paralysis of the muscles of the eye, may be mentioned, softenings of the brain; effusion of blood; tubercular deposits; aneurisms; impermeability of some of the blood-vessels of the brain; tumours situated within the brain, and pressing upon the nerves, hydrocephalus, etc.

The nature of the *diplopia* may afford us much assistance in our diagnosis, and aid us in endeavouring to localize the affection which causes the paralysis. The *diplopia* which is dependant upon cerebral causes shows one very great peculiarity; we find, namely, that the double images in these cases show a very great disinclination to be united. Even with the most carefully selected prism it is found difficult, or even impossible to unite them; and even if we have effected this, the *diplopia* generally awakens again as soon as a very slight alteration is made in the strength of the prism, or in the position of the object. If we find that several muscles, which are supplied by different nerves, are paralyzed, as for instance *R. externus* or *O. superior*, together with one or more muscles supplied by the *oculomotorius*, particularly if both eyes are affected (and we can find no cause within the orbit), we may suspect some central lesion. The same may be said with regard to a succession of paralyses

in different muscles. If several of the muscles, furnished with nerves of the third pair are *successively* affected, and then perhaps the *trochlearis* or *abducens* also, and after this, one or more muscles of the other eye, we are justified in thinking of a cerebral cause.

The *prognosis* in cases of paralysis dependant upon causes situated at the base of the brain, or within the brain itself, must be more or less dubious. We find, however, that a complete restitution may occur if the primary affection recede, as in cases of effusion of blood, exudations, etc. We should, however, be always guarded in our prognosis, more particularly if the paralytic affection be extensive, and dependant upon cerebral causes.

The *treatment* must vary according to the nature of the suspected cause.

With regard to the *general* prognosis of paralysis of the muscles of the eye, it may be laid down as a rule, that the prognosis is favourable in proportion to the freshness of the paralysis. We must, however, also take into consideration the extent of the affection, for the prognosis is better in partial than in complete paralysis. For instance, a partial paralysis of two years' standing affords a relatively better prognosis than a complete paralysis which has only existed a quarter of a year. The character of the *diplopia* is also prognostically of importance. We find, for example, that double images which show only a lateral difference (as in cases of paralysis of the *R. internus or externus*), warrant a better prognosis than the *diplopia,* which presents also a difference in the height of the images. The reason of this is, that the lateral images, more particularly the homonymous, are far more easily united than those which stand above one another. In fact we sometimes see, that in slight cases of paralysis of the *abducens* or *R. internus,* a spontaneous cure is brought about by the domination of the act of vision, which causes the double images to be united. We must, however, be upon our guard, that at a certain stage of the recovery, the tendency rather to extend than diminish the

distance between the double images does not arise and frustrate all our therapeutic endeavours. This tendency is caused by the great annoyance which double images produce when they are very close to each other; if the patient cannot unite them, he overcomes this annoyance by increasing the distance between them by the contraction of some muscle. It will be often necessary to make the patient wear spectacles, of which the glass for the affected eye is covered with paper, or is darkly coloured, in order to exclude this eye completely from the act of vision.

The following reasons may necessitate such a proceeding. 1. In order to prevent any annoyance and confusion from the *diplopia,* and the feeling of dizziness which is often caused by it. 2. To obviate the tendency to enlarge the angle of squinting, in order to lessen the annoyance of the *diplopia* by increasing the distance between the double images. 3. To combat the inclination of the patient to assume an awkward carriage of the head.

An erroneous idea prevailed formerly, that squinting or a paralysis might be cured by the use of so called "squint spectacles." The healthy eye was excluded from any participation in the act of vision, and the affected eye was made to adjust itself upon the object. The error of this proceeding becomes at once apparent, when we consider what the healthy eye does under this exclusion. If, for instance, in paralysis of the *R. externus* of the left eye, the right eye is covered, the left will make an excursion outwards (say of 1 line) in order to adjust itself upon the object. The right eye wil not, however, retain its position, but will make a simultaneous movement inwards, not of 1 line, however, but perhaps of $1\frac{1}{2}$—2 lines; for we have before pointed out, that in *all* cases of paralysis, the secondary angle of squinting is greater than the primary. In time, therefore, even supposing that the paralysis be cured, and the left eye always adjusted upon the object, we shall have produced a squint in the right eye greater in extent than the former deviation of the left eye. For this purpose, therefore, these glasses are to be thrown

aside, but they are very applicable and useful in those cases of *strabismus*, in which we desire to change a monolateral into an alternating squint. After a *strabismus* operation, it is often necessary to make the patient wear a peculiarly constructed pair of "squint spectacles," in order to cure him of a lateral carriage of the head which he may have acquired. Suppose the patient shows after the operation a tendency to carry his head turned towards the right, we should prescribe for him a pair of spectacles of the following construction. The glass of the left eye must be completely covered, so that the left eye is excluded. About the inner two-thirds of the glass of the right eye should be also covered, the outer third being left transparent for the patient to see through. In order to find his way about he will now have to turn his head towards the left, so that he may bring this opening in the spectacles nearer the middle line of his body, his head will therefore be now turned just in the opposite direction to that in which he was accustomed to carry it, and this practice is to be prolonged until the desired result has been obtained.

A similar proceeding may be used in those cases in which we desire to extend the effect of a tenotomy operation as much as possible.

We generally apply *exclusion* of the affected eye in cases of complete or complicated paralysis, but in partial paralyses, if they are not of too great an extent, we may often make a most advantageous use of prismatic glasses.

In my paper upon the paralysis of the *R. externus*, I have pointed out in what manner prismatic glasses are to be used for therapeutic purposes, and explained their mode of action. Our treatment is here based upon the physiological fact, that double images which are very near each other, act in such a manner upon the *retina*, that the latter is incited to call up through reflex action, a muscular effort which shall either unite these double images, or else deprive them of their annoyance by separating them still further from each other. What we desire, therefore, by this therapeutic

use of prisms is, to stimulate the paralyzed muscle to contraction by approximating the double images, and thus heightening their confusing effect. The affected muscle will then make a voluntary effort to unite the double images, and will generally succeed if the tendency to single vision is sufficiently powerful, and the distance between the double images not too great for the facile and easily continued exertion of the weakened muscle. In those cases, however, in which the tendency to unite the double images is absent or but very slight, or where too strong a prism (about 14°) would be required for the necessary approximation, we must not apply prismatic glasses for the purpose of exercising the muscle, in order to free the patient from his *diplopia*, we must therefore give him a prism sufficiently strong to unite the double images at once.

When there are only lateral differences in the double images, the mode of applying the prisms will be at once apparent. If the *R. externus* is paralyzed, we turn the base of the prism outwards, the reverse will obtain in a case of paralysis of the *R. internus*.

When the double images show not only a lateral difference, but also a difference in their height, our object must be of course twofold, viz., to compensate not only the lateral differences, but also those in the attitude of the images. And this we may do in various ways.

Let us for the sake of an example take a paralysis of the *O. superior*. The reader will remember that there is a convergent squint in the paralysis of this muscle, and that the cornea of the affected eye stands somewhat higher than that of the other. The double images are therefore homonymous, and that of the affected eye is projected *beneath* the other. We may apply prismatic glasses for the purpose of compensating these differences in several different ways.

I. The simplest way would be to turn the base of the prism somewhat downwards and outwards.

II. We might apply two prisms, one with its base downwards, the other with its base turned outwards.

III. We might divide the prism between the two eyes, viz., place the one prism before the affected eye with its base turned downwards, and thus correct the differences in the height of the double images. We then apply the other prism with its base turned outwards before the healthy eye, and the following result will ensue. The rays of light (in the healthy eye) being refracted towards the base of the prism, will fall upon a portion of the *retina* external to the *macula lutea;* the eye will therefore make a movement inwards in order to bring the rays of light again upon the yellow spot, the affected eye, however, makes at the same time an associated movement outwards. Now, if the laterally applied prism is of the proper strength, there will be a complete liquidation of the *diplopia,* and single vision will be the result, for we must remember that the differences in the height of the images have been already annulled by the prism which was placed with its base downwards before the affected eye.

IV. In accordance with the fact that the eye spontaneously overcomes the lateral differences far more easily than those in height, we often find that if we compensate the latter by a prism with its base turned downwards, the affected eye will then by a spontaneous contraction of its *abducens* move the eye slightly outwards. The rays will thus be brought again upon the *macula lutea,* and the *diplopia* disappear.

We shall afterwards find that the knowledge and remembrance of this fact may often prove of advantage in those cases in which we perform tenotomy, for the purpose of delivering the patient from the annoyance of *diplopia.*

We have next to examine the course which a paralysis may run, and the different processes which it may give rise to.

" The greater or less power of the act of vision over the

muscles of the eye explains in a great measure the very different issues (Ausgänge) of paralyses, which we have already pointed out at page 186. If the sight of the affected eye is weak, or if any differences exist in the refracting power of the two eyes which predispose to an exclusion, a deviation towards the opposite side will very soon occur, and then if the innervation returns, a *strabismus concomitans* will afterwards arise, or if the paralysis continues, a contraction-paralysis. If on the other hand there is a lively impulse towards co-operation, the deviation towards the side of the antagonist will be opposed to the utmost, and the original symptoms of the paralysis will be preserved unaltered."*

Paralysis may run the following different courses :—

I. *It may be completely cured.*—This is particularly likely to happen if the paralysis is fresh and owing to some peripheral affection. The mobility of the paralyzed muscle increases, the deviation becomes less and less, and the *diplopia* diminishes until at last a complete restitution is brought about.

II. *Incomplete restitution.*—Here we find that all goes well up to a certain point; the cure appears to be progressing towards a favourable termination, when all at once this progress is arrested at a certain stage and a greater or less degree of paralysis remains behind. If the tendency to single vision be strong, this state may last however for a length of time without any secondary contraction of the antagonist. Or again, no restitution takes place, and the extent of the paralysis remaining unchanged, the symptoms of a fresh paralysis are retained. Generally, however, this state lasts but a very short time without passing over into a secondary contraction of the opponent, and this brings us to—

III. *Secondary changes in the antagonist.*—Let us for the sake of illustration again suppose a case of paralysis of the *R. externus* of the left eye, in which the mobility of the eye outwards is completely or partially lost.

* Von Graefe's Archiv., vol. iii, part 1, p. 339.

When the object is moved over to the left side of the patient, the affected eye lags behind, so that *strabismus convergens* arises, which increases in extent the farther the object is moved to the left. When it is held in the middle line or a little towards the right of it, both optic axes will be adjusted upon the object, and follow it accurately throughout the right half of the field of vision. After the paralysis has lasted some time, the *diplopia* begins to extend more and more into the right half of the field of vision. In fact the antagonist (*R. internus*) owing to the lesser burden which it has now to overcome, undergoes changes in its structure which lead gradually to its contraction. The case will now present a mixture of symptoms which belong partly to the paralytic affection and partly to the *strabismus concomitans*. To the first category belong the following. The greater or less immobility towards the side of the paralyzed muscle; the fact that the secondary angle of squinting is greater than the primary; and lastly that the angle of squinting is greater towards the left side than towards the right. From a common paralytic affection it is however to be distinguished by the fact that the deviation is greater in the middle line than in a case of simple paralysis of the *abducens*, and also by the extension of the deviation and the consequent *diplopia* far into the right half of the field of vision. The original paralysis may now be partially or completely cured. If the latter be the case the mobility outwards will be restored, but the deviation inwards will continue and perhaps even increase. The secondary angle of squinting will now be equal to the primary.

I have before pointed out the fact* that if the eye affected with the paralysis enjoys the better vision of the two, and is used in preference to the other, a secondary deviation (which will be greater than the primary) is produced in the healthy eye and this may eventually pass over into a *strabismus concomitans*.

* Page 140.

Paralyses sometimes pass over into *strabismus spasticus* (*periodicus*). This is particularly the case in those forms which arise when the patient is looking into vacancy, or when the eye is covered by the hand; whereas it is not observed when the patient carefully "*fixes*" the object, for then he forces both optic axes to adjust themselves upon it in order to avoid *diplopia*.

We often see this in those cases when after the cure of a paralysis of the *oculomotorius* the *abducens* becomes somewhat contracted during the restitution of the *R. internus* and then a divergent squint may remain. The domination of the act of vision, however, in general counteracts this and enforces the adjustment of both optic axes upon the object. If we however place a prism of ever so small a power with its base turned upwards or downwards before the affected eye, or exclude the sound eye by placing our hand over it, the deviation outwards becomes at once apparent.

IV. *Contraction-Paralysis.*—No restitution takes place in the paralyzed muscle, the opponent at the same time contracting more and more, the affected eye will (in a case of paralysis of the *abducens*) gradually deviate towards the inner side, until it may eventually be stationed almost motionless in the inner angle of the eye.

Let us now consider the operative proceedings which may be required in these different *issues* of paralyses, for according to the nature of these must we regulate and modify our operation. Although it is often difficult to hit at once upon the modification proper for any particular case, a careful study of the general principles by which we are to be guided will soon enable us to gain a great facility in the proper choice of the operation; and it is in these cases and the allied ones of tenotomy for *diplopia* that we are now enabled, thanks to the admirable practice of von Graefe, to alleviate or cure many hitherto hopeless cases.

*Cases of incomplete restitution of the muscle affected with paralysis, but without any secondary contraction of the antagonist.*—Of course we must try every other means of cure

first, and must not urge the patient to submit to an operation until we have found that all the other remedies have proved unavailing, and that the paralytic affection shows itself, after the expiration of many months, perfectly stationary.

The mode of operation will depend completely upon the amount of immobility in the direction of the affected muscle. Let us assume that, after a paralysis of the *R. externus* of the left eye, the immobility outwards amounts to 1–1½ line, but that there is no deviation inwards, so that the *diplopia* extends only up to the middle line or but slightly into the right half of the field of vision. In these cases von Graefe recommends a simple tenotomy of the antagonist, if there is any *diplopia;* without this it is not worth while to make the patient submit to an operation on account of the very small amount of diminution in the mobility of the paralyzed muscle. Our purpose in operating is to expel the *diplopia* from the middle portion of the field of vision, for this is just the space where it is all important to the patient to enjoy single vision.

If we perform a tenotomy of the *R. internus* and layer the muscle back about 1–1½ line, the following will be the result. The effect is completely *mechanical* and does not act upon the innervation in the slightest degree. By giving the *R. internus* a more backward insertion we diminish its influence upon the eyeball and the latter is now a greater burden for the muscle than prior to the operation. Owing to the weakening of the *R. internus,* the eyeball will now have become a lighter burden for the *abducens,* (still somewhat weak and inefficient from the remains of the paralysis) which will therefore be enabled to move the eye somewhat more outwards, and consequently the deficiency in the mobility outwards will now perhaps only amount to ½–¾ of a line.

In the centre of the field of vision the patient will now enjoy single vision, whilst some *diplopia* will still remain towards both extremes of the field. When the eyes are moved far to the left a slight convergent squint and *homony-*

*mous diplopia* will arise, owing to the slightly remaining immobility of the *abducens* in this direction. The reverse will be the case if the eyes are moved far over to the right of the patient, for in consequence of the slight insufficiency of the *R. internus* a divergent squint will arise at a certain point, and the *diplopia* will therefore be *crossed* in this direction. This will not however annoy the patient in the least, for he will avoid the *diplopia* by slightly turning his head instead of his eyes when he desires to see some object lying very much to either side of him. Even in a normal state of the eyes we seldom make use of these very lateral movements, but we generally turn our head to one or the other side. Experience proves that the crossed *diplopia* does not show itself till far to the right of the patient, and also that the single vision will gradually extend further and further into the left half of the field of vision. Sometimes however this apparently excellent effect of the operation decreases again after some weeks; and this has made von Graefe lay down the rule that when the diminution in the mobility of the paralyzed muscle exceeds 1–1½ line, and if the outermost positions of the eyeball are only attained under continued jerks, and cannot be continuously maintained, it will be better to have recourse to the following operation, viz., the insertion of the paralyzed muscle *is to be brought forward, a partial tenotomy of the antagonist being made at the same time.* This operation is therefore to be performed in those cases in which the want of mobility exceeds 1-1½ line, but ranges between this and 2–2½ lines. *When it exceeds these limits we must layer the paralyzed muscle forward and at the same time make a complete tenotomy of the opponent.*

Our object in bringing the insertion of the paralyzed muscle more forward is to furnish it with an increased power over the eyeball. For we give it mechanically a more anterior (and therefore a more favourable) *point d'attaque.* We have before pointed out that the eyeball is to be considered a globe, the centre of which being fixed, its movements can only be rotations around different axes; if we now

give one muscle a more anterior insertion than its antagonist it must exert a greater power over the eyeball than the latter, and therefore pull it more over to its own side. In the same manner we can correct any dynamic deficiency in the action of one muscle, and the consequent asymmetry of the position of the eye by giving the partially paralyzed muscle a more favourable (*i. e.* anterior) insertion, and we can thus once more equalize the power of the two antagonists. Although the effects of this operation are most excellent in the majority of cases, there are yet a number of circumstances to be considered and weighed which may materially modify the ulterior beneficial results. After a time the paralyzed muscle generally undergoes a fatty degeneration, and this would render it unfit for the requisite amount of contraction even if the innervation were normally restored, and this degeneration also modifies the effect of bringing forward the insertion of this muscle very considerably, so that for a short time after, there may indeed be a tolerable balance of power owing to the more passive opposition of the paralyzed muscle, but after a time the muscle will sometimes yield more or less to its healthily innervated opponent, and the eye will then deviate towards the side of the latter. But we have the following facts to guide us in our prognosis. If a complete paralysis has existed for several years without any considerable contraction of the antagonist having supervened, it may be presumed that it will not occur at a later stage. But if a secondary contraction does exist, the further increase of this will be obviated by the tenotomy of this muscle, for by doing so we increase its burden, or in other words decrease its power. If, however, in spite of all our care, the original effect of the operation is lessened by these changes, we may repeat the laying forward of the paralyzed muscle or the tenotomy of the opponent, or divide the latter operation between the two eyes. Von Græfe therefore advises that in these cases the effect of the operations should at first appear excessive, so that the medium position of the eye appears after a week to be still moved

towards the side of the layered-forward muscle to the extent of $1\frac{1}{2}$—2‴; after 4—6 weeks but little of this excess will be apparent, and at the end of six months it will have disappeared altogether.

In cases of total paralysis we cannot therefore give so favourable a prognosis as in those in which a portion of mobility has returned in the paralyzed muscle, for in these we obtain most excellent results. We not only afford the affected muscle a more favourable *point d'attaque* by bringing its insertion more forward, but also lessen the power of the antagonist by a more or less extensive tenotomy, and we thus not only remove the arc of mobility into the middle portion of the field of vision but even extend it considerably.

We must next explain the manner in which this operation of "layering forward" the paralyzed muscle is to be performed. As it has been but very seldom performed in England, and as great accuracy in carrying out the details is essentially necessary to its success, I think it better to give a translation of von Graefe's description of his operation.

In describing *the layering forward of the paralyzed muscle together with a partial tenotomy of the antagonist* (*by which the latter is but inconsiderably weakened*), he says.* "For this purpose I detach the paralyzed muscle from its insertion in the same manner as in the common tenotomy operation, with this difference only, that after the detachment, I, with a pair of Cooper's scissors, also sever pretty far back any loose adhesions (if any such exist), between the posterior surface of the muscle and the sclerotic, and also incise the connective tissue somewhat on each side of the muscle. Although I make the conjunctival wound somewhat larger than in tenotomy, it must not be extensive, I however loosen the textures between the *conjunctiva* and the anterior surface of the muscle more than in that operation. Though the muscle will still indeed (as in tenotomy) adhere by its lateral attachments it will yet, together with the layer of cellular tissue, permit itself to be freely and extensively slid either in a forward or backward direction upon the sclerotic. Owing to this fact, a retrogression of the muscle (Rücklagerung) of unusual extent would ensue, if the eye were left to itself. But if instead of this, we on the contrary desire to bring about a shifting of the muscle *towards* the *cornea*, it will be necessary to take care that the eye be turned completely into the corner corresponding to the detached muscle, and that it

* Archiv., vol iii, part 1, p. 341.

be there immovably retained until the muscular layer becomes attached to the surface of the sclerotic in the desired position."

"Just as the detached muscular layer slides back *in maximo* upon the sclerotic when the eye is turned into the oposite angle, will it glide *in maximo* towards the *cornea*, if the eye is turned towards the side of the operation, so far indeed that it may even, if desired, be made to lie upon the *cornea*. With respect to the *cornea* we need not fear such an excessive layering-forward. In cases of *strabismus divergens*, after paralysis of the *oculomotorius*, I have sometimes turned the eye so far into the inner angle, that quite the inner third of the *cornea* was covered by the detached muscle. Adhesion appears to be prevented through the epithelial layer of the *cornea*; afterwards the muscular layer always retracts behind the edge of the *cornea*, most likely owing to the cicatrization in the subconjunctival tissue which lies behind it. It must however depend upon the individual lesion whether or not we desire to bring the muscle forward to so great an extent. After the first part of the operation, viz., the detachment of the paralyzed muscle and its layer of connective tissue is finished, I pass on to the second part of the operation, which concerns the antagonist."

"I make, just as in tenotomy of the latter, a small conjunctival wound, and just as small a wound in the subconjunctival tissue, and then draw forth the tendon with a *strabismus* hook. It is not necessary that the hook should sustain the whole breadth of the tendon, but only sufficient to afford a firm hold during the application of a suture, and also to present distinctly the conditions of the situation of the insertion. I now pass a curved needle, with a silk thread beneath one margin of the tendon, and pierce the latter close to the sclerotic, from behind forward, in such a manner that the thread embraces a good half of the tendon, I then tie the suture also close to the sclerotic and give the two threads to an assistant with the direction to draw them gently towards the opposite side (the *cornea*), whilst I myself draw the tendon away from the sclerotic towards the angle of the eye by means of a hook. In this way the part of the muscle which lies between the suture and the hook is put upon the stretch, and may with a pair of scissors be divided about $\frac{3}{4}$ of a line behind the suture, without any fear of injuring the latter. That half of the tendon which is constricted by the suture, still better $\frac{3}{3}$–$\frac{3}{4}$ of it, will be at least divided; indeed this should be regulated according to the amount of the resistance which we anticipate from this muscle in the lateral movements of the eye. Should the patient complain of an annoying sensation of tension during the movement of the eye, the hook must be once more introduced beneath the undivided portions of the muscles and these with the exception of a few fibres, are to be cut. As the operation lasts far longer than a simple *strabismus* operation I recommend the use of chloroform. Shortly after the operation, or at all events a quarter of an hour after it, the dressing is to be applied; the eye having been properly cleaned and the patient after he has recovered from the chloroform having been comfortably placed in bed. The object of the dressing is, as has already been explained, to keep the *cornea* during 24–36 hours immovably fixed in the corner of the

paralyzed muscle. The thread which is passed through the tendon of the antagonist serves to do this. In order not to call up any reaction the dressing should be so applied that the *cornea* remains untouched by it; moreover the closure of the lids should be possible without the thread being pressed into the intermarginal portion of either lid. To attain the former *desideratum* the thread must rise up somewhat perpendicularly from the place of its implantation; if the eye is to be turned inwards we cannot desire a better support for the thread than the bridge of the nose. The great extent to which the *cornea* is inverted will in this case also protect it. In case the nose should not be sufficiently high, an artificial support may, by means of a roll of plaister, be applied against it side. Upon the cheek of the opposite side of the face the thread is to be kept in the desired position by strips of plaister. In order to prevent any shifting, it is best to lay one strip of sticking plaister about 2 inches long over the course of the thread, press the plaister firmly down for a few minutes and then fasten it by means of some cross strips.

Any other fastening is hardly necessary. Should the thread however, after having been attached in this manner, press in between the edges of the lids when these are closed, it will be necessary either to choose some other point of the bridge of the nose as *hypomochlion*, or if the thread slips off from this, we may retain the former spot, but change the direction of the thread in the proper manner, by means of a loop of plaister placed between the eye and bridge of the nose and fastened on the forehead or cheek. If the eye is to be turned into the outer corner, it will be necessary to make use instead of the nose of an artificial elevation, made of a roll of plaister, The roll is to be applied to the outer edge of the orbit and steadied by means of similar rolls of plaister coming from the temple. As displacement occurs very easily, the dressing is in this case somewhat troublesome.

"The patient should remain quietly in bed until the thread is taken out, and the attendant should be watchful that the dressing does not shift. Should this however occur, it must be at once remedied and it is advisable that the Surgeon should himself do this."

(2.) *Bringing the insertion of the muscle forward together with complete tenotomy of the antagonist (by which the latter is considerably weakened.)*

"The first half of the operation remains the same; the paralyzed muscle with its layer of cellular tissue is to be made to slide upon the sclerotic in the manner above detailed. On the other hand, we pass a larger hook beneath the whole breadth of the tendon of the antagonist, we then take a silk thread at each end of which is attached a curved needle. We thrust, from before backwards, one needle through the middle region of the tendon but nearer one edge than the other, and pass it out at the free edge of the tendon; it should embrace a good third of the breadth of the tendon. The second needle should be passed to the other side in a symmetrical manner and the suture be tied close to the sclerotic. Within it will lie the two external thirds of the tendon, whilst the inner third is excluded. The tendon, in its whole extent, is then to be divided between the hook and suture. The purpose of the suture here recommended is to avoid its being prematurely

torn out. This purpose is here particularly needful, as we apply the mode of operation in question in those very cases in which the turning of the eye offers very considerable resistance, viz., contraction-paralyses. In order that such a suture should fail, either the two outer portions of the muscle must separate, or the portions of the muscle between the two places of puncture must be destroyed lengthways and the thread then slips off. If we only encircle the muscle, the suture very easily slips off; the premature detachment of the suture is less surely provided against if we transfix the muscle at one point than if we pierce it at two places. The dressing should be the same as in the last case."

A few words will suffice as to the after treatment.

The pain caused by the dressing usually soon subsides, should it however prevent sleep, cool water dressings may be periodically applied, but only as long as they are really necessary, as they tend to loosen the dressing. *Œdema* of the upper lid without any conjunctival irritation is of no consequence. As a shifting of the dressing within the first 8—12 hours may completely frustrate the object of the operation, it is necessary for the operator to see the patient frequently during the first twelve hours. The thread must remain in 20—24 hours, but if the patient has no pain, it may be kept in 36—48 hours.

In the second class of cases, where the antagonist has undergone secondary changes, and a variable amount of paralysis remains, our treatment must also be modified and varied according to the peculiarities and exigencies of each case. If the paralysis has given rise to a *strabismus concomitans*, but the original paralytic affection has eventually quite disappeared, we must treat this exactly as a common case of *strabismus concomitans*, and be guided by the same rules as hold good in that affection.

For illustration's sake, let us again suppose a patient affected with a paralysis of the left *abducens*. After this has existed for some length of time, there will arise, on account of the diminution in the opposition of the *abducens*, some changes in the elasticity of the *R. internus*, and changes of its structure will soon follow in their train. The deviation inward will increase, and the *diplopia* will extend more and

more into the right half of the field of vision, and then when the paralytic affection has been successfully cured, and the mobility in the direction of the affected muscle has been restored, we find a well-defined *strabismus concomitans* remaining. At this period it is often exceedingly difficult to ascertain with certainty whether or not a paralytic affection has previously existed.

At a somewhat earlier stage, however, whilst there are still some symptoms of the paralysis remaining, we can readily trace the differences between them and the symptoms of *strabismus concomitans* developing themselves. I have before pointed out how this mixture of symptoms can be unravelled. In these cases where the original paralysis has gone over into *strabismus concomitans*, and the paralytic character of the affection is almost completely lost, I repeat that we must operate as in an ordinary *strabismus concomitans*.

I have before stated, that if the eye affected with the paralysis enjoys the better sight of the two, and is used by the patient in preference to the other, a *strabismus concomitans* may arise in the latter.

Let us again assume that the *abducens* of the left eye is paralyzed. This eye enjoys, however, the best vision, and the patient, therefore, in spite of the inconvenience, uses it in preference to the right eye. A secondary angle of deviation will arise in the right eye, and this angle will be greater than the primary. In time, the right *R. internus* will undergo changes in its structure, and become secondarily contracted. We shall now have a *strabismus convergens concomitans* of the right eye after a paralysis of the *abducens* of the left.

How are we to treat this?

Let us suppose that the deviation of the right eye amounts to 2 lines, and the defect in the mobility towards the side of the *R. externus* of the left eye $\frac{3}{4}$—1 line. At the first glance it might appear best to perform a tenotomy of the *R. internus* of the right eye. A moment's reflection will point out the disadvantage of such a proceeding.

Towards the left side of the patient there is a diminution in the mobility of the left eye in consequence of the paralysis of the *abducens*. If we now divide the tendon of the *R. internus* of the right eye, we shall also render the movement of this eye over to the left side difficult, and the associated movements towards the left will be executed with difficulty with both eyes; those towards the right will on the contrary be rendered abnormally easy. In consequence of this the patient will carry his head turned towards the left, in order to avoid the necessity of turning his eyes in this direction. For this reason it will be better, therefore, to divide the operation between the two eyes, and make a slight and carefully executed tenotomy of both *RR. interni*.

We should now have to speak of the operative treatment of those cases in which the paralysis has given rise to a *strabismus periodicus;* but as I shall in future pages enter more fully upon the subject, I must, in order to avoid repetition, defer its consideration until that time.

We find a great variety of forms in those cases which present a mixture of the symptoms of the remaining paralysis, and the supervening development of *strabismus concomitans;* they vary according to the extent of the restitution in the paralyzed muscle, or the secondary contraction of the opponent.

If the paralysis remains complete, and the secondary contraction of the antagonist goes on progressing, it will at length pass over into *contraction paralysis*. In the latter case we must layer-forward the insertion of the paralyzed muscle, and perform a complete tenotomy of the antagonist. We must not, however, be too sanguine in our prognosis, for in some cases we may have to operate more than once before we arrive at a very favourable result. A great amount of mobility often slumbers beneath the fibrous degeneration of the antagonist. In order to illustrate this, von Graefe mentions the case of an old woman whose *corneæ* were almost immoveably buried beneath the *caruncul*æ; after being three times operated upon (twice the operation of

layering-forward, together with tenotomy was performed, and once a single suture operation)*, the optic axes were almost parallel, and a free mobility existed throughout the greater part of the field of vision.

In those cases in which the paralytic affection has been partially cured, but with a secondary contraction of the opponent, we must be guided in our operative proceedings by the individuality of each case. Our chief aim must be to lighten the burden of the paralyzed muscle by means of layering its insertion more forward, and by weakening its antagonist by tenotomy; and our end purpose to confine the *diplopia* to the peripheral portions of the field of vision and expel it from the central portion. I trust that I have explained this part of the subject sufficiently to render it an easy matter for the reader to adapt or modify the treatment according to the exigencies of each individual case.

Let us now shortly consider to what operation we must have recourse when the double images show not only lateral differences but also differ in height. Here the considerations are more complicated, and must be well weighed before we decide upon an operation. As an example of this class of cases, let us assume a paralysis of the left *O. superior* with a secondary contraction of the *O. inferior* of the same eye. The reader will remember that such a case would present the following symptoms. Beneath the horizontal median line the left eye will, owing to the paralysis of the *trochlearis*, stand higher than the right eye, and will also deviate inwards, so that the double images will differ in height and be homonymous; the *pseudo*-image will be *beneath* and to the left of the image of the right eye, and this difference in the height of the images will increase as the eyes are moved towards the right side of the patient and decrease in the opposite direc-

* This suture operation is thus performed. Before the tendon is divided a thread is drawn through it, and the eye is turned by means of this suture towards the opposite side for 24–36 hours. This operation is sometimes advisable in cases of partial paralysis of the *R. internus*, which threatens to pass over into the *strabismus divergens*.

tion. Above the horizontal line there will be a divergent squint, for owing to the contraction of the *O. inferior* the left eye deviates upwards and outwards, the double images will consequently be crossed, the *pseudo*-image will lie beneath that of the right eye, and the differences in the height of the images will also increase towards the right, and decrease towards the left side.

While deliberating upon the operative treatment of such a case, we must remember the fact that double images which show a twofold difference (laterally and in height) will often unite if one of these differences only is corrected. We have mentioned this when speaking of the choice of prisms, and have pointed out that if the differences in the height of the images are corrected, the lateral differences are often annulled by the spontaneous action of the *R. internus* or *externus*. Here I must, however, refer to another fact, viz., that even if after the correction of the differences in the *diplopia* in one direction (say in height) by means of prisms, the lateral differences should persist, we sometimes find that the latter will disappear after an *operative* treatment of the former.

Suppose, then, that we find that the differences in the height of the images are the chief disturbing causes to our patient, we must by our operation endeavour to equalize the height of the two eyes. This may be done either by lowering the left eye, or elevating the right. In the former case we should have to divide the *R. superior* of the left eye. What would be the result of such an operation? The lower position of the left eye (through insufficiency of the *R. superior*) would occur chiefly when this muscle is called into action, *i. e.*, upon looking upwards. This would not, however, be favourable to the patient, for it is essentially necessary that the lower half of his field of vision should be nearly free from *diplopia*, as for all the common purposes of life our optic axes are directed slightly downwards or straightforward, and we must therefore endeavour to equalize the differences in the height of the double images chiefly for

this portion of the field of vision. This may be done by dividing the *R. inferior* of the right eye, and thus elevating the latter. The right *cornea* will then stand higher through the vertical extent of the field of vision. The insufficiency of this muscle would show itself most when the patient looks downwards, therefore just in that direction in which we particularly want to equalize the height of the *cornea*. The differences in the height of the double images were found to be greatest when the eyes were moved over to the right. The inefficiency of the *R. inferior* dexter in lowering the *cornea* will also be most conspicuous in this direction, for it will be remembered that this muscle exerts most influence upon the height of the *cornea* when the eye is turned outwards (to the right).

I have only just touched upon this subject here, so as to give the general rules of treatment in such cases.

# Periscope of Foreign Ophthalmology.

TRANSLATIONS AND ABSTRACTS OF IMPORTANT PAPERS PUBLISHED ABROAD.

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## *DISEASE OF THE CHOROID, VITREOUS HUMOUR AND RETINA IN BRIGHT'S DISEASE, TOGETHER WITH A PECULIAR FORM OF EMBOLUS.**

### *By Heinrich Müller.*

The attention of pathologists having of late been so much directed to the changes which the structures within the eye undergo in the amaurosis accompanying Bright's disease, a short account of a paper upon this subject by such an authority as H. Müller, will I am sure prove acceptable to the profession.

Hitherto descriptions have only been given of the changes which occur in the retina in morbus Brightii, Müller however, has observed not only changes in the retina, but also in the choroid and vitreous.

In a young man who died of granular atrophy of the kidneys, with dropsy, and in whom a marked amblyopia had shown itself, Müller had the opportunity of examining the eyes and noticing the following changes, (one eye was examined fresh the other after having been hardened) :—

1. The choroid was thick, strongly pigmented, but with the exception of some whitish stripes, it did not to the naked eye seem particularly changed in appearance. In these situations, however, as well as in some others, a microscopic examination showed in both eyes extensive changes in the blood vessels.

*The walls were thickened by a homogeneous mass, which refracted light very strongly,* while the veins were here and

* Würzburger Medicinische Zeitschrift, vol. i, part 1, 1860.

there but slightly changed; several branches of the posterior ciliary arteries were most extensively implicated, and particularly most frequently and intensely there, where covered by the vasa vorticosa, they give off, from the equator of the eye up to the neighbourhood of the ora serrata, branches which pass over at once into the choriocapillaris. From these points the changes appeared not only to proceed towards the capillary expansion, but also backwards towards the branches themselves; there the irregularity in the changes was also most marked, so that the condition of the walls of vessels lying close together varied exceedingly, and owing to this the radiations of the ultimate arterial twigs acquired externally a peculiar beaded appearance. Müller, found that here, through thickening of the walls inwards, the vessels were narrowed, or even completely blocked up. This occlusion varied very much in extent, and between these portions of vessel clefts and cavities of various shapes existed. As a rule but few blood-corpuscles were wedged into the occluded portions, and this was evidently owing to the opportunity of turning aside, which was afforded them by the numerous communications. In this way (as was also noticed in a former case) quite solid hyaline stringy masses had sometimes been formed, whose thickness varied up to 0·05 mm.; here and there, however, a thick mass of blood-corpuscles might be seen wedged into the closed portion of vessel, which was then sometimes sinuously dilated.

The successive thickening of the walls did not, however, seem to be the only mode in which the arterial twigs were occluded, for this appeared to be brought about also by the coagulation of a substance filling the vessels. For in arteries of about 0·06 mm. in size, longish plugs were met with, which upon pressure detached themselves from the walls of the vessel and split up, further on they passed however into softish masses, which sometimes contained blood-corpuscles in greater or less quantity, sometimes however the column of blood was completely interrupted. Some portions were quite homogeneous, others contained small celled vesicular or drop-like bodies. Müller thinks that although these may have partly originated from the colourless blood-corpuscles, they may also in part be most certainly traced back to the epithelium of the blood vessels. "Even normally the epithelium of the ciliary arteries is generally very strongly developed, and consists of very long spindles. In the choroid in

question (even in the hardened eye) it was often loosened and detached, and in conjunction with this, numerous young round cells were formed, in such a manner indeed, that an hypertrophy of the epithelial cells appeared most probable. At all events, a fatty degeneration of the same was very evident, for the spindle-shaped cells could be seen filling themselves with globules, swelling up and becoming ventriculous."

"These different masses which occurred in the larger arterial branches, such as detached and degenerated epithelial cells, young cells and free masses of fat, were here and there wedged into the smaller twigs. In this way a peculiar form of embolus arose, which is distinguished by occurring quite peripherally, since the produce of the arteries which are themselves already very small, is at once wedged into the capillary branches. Even in appearance this obturating mass distinguished itself through the large fat globules, from the finely granular substance, which we find in the vessels of the choroid and retina in intense (particularly metastatic) inflammation of the eye. We must not, however, even in the latter case, at once take the endocarditic origin of this mass (which is found, quite similar in appearance, also on the outside of the vessels) for granted; I have before pointed this out, and more lately Virchow has also agreed with this view." Müller thinks, however, that the occurrence of embolus in the case before us should not be invested with too much importance, as it was only found in certain individual places, and no further consequences could be observed with certainty; the latter may, however, also be owing perhaps to the numerous anastomoses. He thinks also, that the fact of the fatty degeneration and embolus being wanting in many places must even give rise to the doubt whether we must not look upon it as a secondary process.

He also frequently found partly in the vessels, partly in their neighbourhood, irregular yellowish-brown lumps, such as otherwise originate from the colouring matter of the blood. Although a part of these masses may have been brought about through stagnation and metamorphosis of the blood, similar appearances indicating an infiltration, were also present in situations where neither degeneration nor embolus occurred, and no particular obstructions existed, so that we must suppose that disturbances in the nutrition may have even occurred beforehand. The fact that the pigment epithelium of the choroid, which was otherwise well preserved, adhered

more firmly to the choriocapillaris at the affected spots, so that it could be less easily detached, may perhaps stand in some connection with this.

In the stroma of the middle choroidal layer, between the larger vessels in the anterior half of the choroid, largish round cells were met with; these appeared sometimes to be in the commencing stage of fatty degeneration.

"Finally we must mention that in the stroma between the larger vessels, as well as in the suprachoroid (which was very much developed), on the one hand an unusual number of fibres were seen which were supposed to be unstriped muscles, on the other some peculiarities were observed in the ganglionic nervous plexus, to which I shall recur hereafter."

## 2. Vitreous Humour.

In the fresh eye Müller observed nothing particular, in the hardened eye, however, he met with a peculiar whitish opacity on the external surface (corresponding to the fundus), which presented great peculiarities on microscopic examination.

"On the one hand the cells of the vitreous were more numerous than normally, varying in size up to 0·025 mm.; some were round, others showed processes, some contained hyaline drops, which however also occurred free (through dehiscence)." These cells were evidently undergoing a process of hypertrophy, for large vesicular-form dividing and double nuclei could be seen."

Besides this, other formations were found in great quantity. These were small rods, at the utmost about 0·001 in breadth, and of very varying length; the shorter ones had frequently a more considerable but uniform thickness, whereas the larger ones were generally strongly pointed at each extremity. The larger ones were often somewhat bent and could by shifting, etc., be entangled into a coil; they were evidently pliable and not brittle; at one time they might be compared to fat crystals, at another, to spindle-shaped spermatozoa. That they were not fat crystals was proved by their not disappearing after having been treated for some hours with ether; glycerine had also no effect, nor did acetic acid change them; they disappeared however after being treated for some time with potash. Müller considers them as a pathological formation in the vitreous, dependant upon a diseased condition of the neighbouring parts; he thinks

that the extent of their occurrence is a proof of this, for they were only found near the hyaloid of the fundus of the eye, and were wanting in the depth of the vitreous, and more anteriorly also at the periphery. The hypertrophy of the cells extended somewhat further forward in the vitreous than the rods. It is however worthy of notice that the implicated portions are just those which lie closest to the most diseased portions of the retina.

### 3. Retina.

The fresh right eye being divided in the equator, presented to the naked eye a great number of partly white, partly red spots; one blood speck lying yet in the macula lutea, while others extended up towards the equator. The retina was evidently more opaque than usual, more particularly towards the entrance of the optic nerve; on account of this opacity a little pit, which existed just here, was very evident even to the naked eye.

Upon a microscopic examination the following changes were noted in the retina:—

*a.* An unusual resistence of the elements and capability of being isolated, so that although the body was already much decomposed, the bacilla and cones could, together with the granules and fibres appertaining to them, be beautifully demonstrated. Individual radial fibres with their nuclear dilatations, and a number of granules and bacilla adhering to them, could be isolated as well as if the retina had been slightly hardened; perpendicular sections could also be made without any further preparation. The granular cells which are generally not easily demonstrated, could also be well seen.

As Virchow and Müller have seen this peculiarity in the retina in other cases, the latter thinks that we are perhaps justified in attributing it to a peculiarity of nutrition. The importance of this resistance and capability of isolation must however be only relative, as we find this differing a good deal not only in different individuals but also in animals.*

He thinks also that the diffuse opacity is most likely dependant upon this condition, which is apparently often also found in situations where no heterogeneous deposits have yet taken place.

* We may call this, with Virchow, sclerosis.

*b. Extravasation of blood.* Clusters of blood-corpuscles were found lying in those places which presented a slightly reddish-striped, or punctuated appearance, chiefly in the nervous layer, or those lying next to it. The more intensely red spots were formed by more aggregated clots of blood, which had partly advanced into the granular bacillar layer.

Müller also points out the fact that, particularly in the intergranular layer, largish hollow spaces easily arise, which are completely filled with heterogeneous masses and, as several of these compartments contained pure fresh blood, whilst in others a metamorphosis of the blood had already set in, he considers that these effusions differed most likely in age. In the one eye he found at the yellow spot, between it and the somewhat detached hyaloid, a little heap consisting of blood-corpuscles and granular masses, evidently produced by a retinal hæmorrhage which had burst inwards.

*c. Nests of ganglion cell-like bodies, which proceed from hypertrophied nerve fibres.* Although these peculiar bodies imitated also in this case most closely ganglion cells with their processes, Müller still retains the same opinion with regard to them, which he expressed in a former paper.*

Here also their position spoke for their being hypertrophied nerve fibres, for the chief mass of them, in fresh as well as hardened preparations, did not appertain to the layer of the larger ganglion cells but to the nerve fibres. Where these nests are so much developed that they extend through the whole thickness of the nervous layer, and crowd this (increased to several times its normal thickness) forward against the other layers, it easily happens that the limits between the undoubted ganglion cells and the ganglio-form varicosities become obliterated. In some places we may, however, see the latter separated from the real cells by normal bundles of nerve fibre, and these may be seen distinctly to pass over them as such. Besides this, all the transitions of form, from normal nerves into the ganglio-form bodies, could here again be closely followed; and many nerve bundles appeared for a certain distance simply broader and beset with greater varicosities than is normally the case. These dilatations also sometimes assumed very much the appearance of extended non-nucleated cells, and as these appearances link themselves closely on to those described by Müller in a former case, he thinks himself justified in the supposition that they are to

* Græfe's Archiv, vol. iv, part 1, p. 41.

be placed in the same class of pathological changes. In our case, after becoming much distended, these varicosities only exceptionally remained without a nuclear-like body. These apparently nucleated bodies which were also very much extended in length were however only very varicose fibres; in no case could the nuclear-like bodies be described as undoubted vesicular-form nuclei, but rather as roundish lumps, which, darker than the surrounding substance, were at the same time opalescent.*

But Müller thinks, that these bodies are certainly not to be considered as altered cells of the ganglion layer of the retina. This does not, however (as he points out), exclude the probability that these bodies may be found to have a certain relation to nerve cells; he at the same time recalls our attention to certain facts, viz., the presence of peculiar nodules which he has found normally in the ciliary muscle,† and the nature of the choroidal nerve texture (*vide* his paper on unstriped muscles and nerves of choroid, Würzburger Verhand. vol. x, p. 179), in the amblyopic eye before us. In the pale nerves of the choroid those situations which contained nuclei were often swollen, and in the foci of these webs such numerous groups of nuclei were seen as Müller has never before met with.

The whole development of the ganglionic choroidal plexus was besides this of such a nature, that the question of an hypertrophy of the nerves naturally arose.

Müller could not with certainty demonstrate any hypertrophy in other portions of the nervous elements of the retina trunk of the optic nerve, ganglion cells, etc., the latter appeared sometimes somewhat larger than natural, but he could not see an hypertrophy with opalescence as in the nerve fibres. The fibrillæ of the cones were however in the yellow spot of the one eye so large and opalescent, that they looked almost like the cones themselves, and the granules of the latter were such large, distinctly bipolar cells containing

* On the application of carmine, Müller found that these varicosities become very red, the nuclear-like bodies assuming a still darker dye so that they presented still more the appearance of cells. It is however a well known fact (as M. points out) that the normal nerve fibres of the retina, as well as axis-cylinders which have been isolated from the white tubular fibres become coloured in the same way. In very broad nerve fibres (*e. g.* of fish) we may demonstrate varicose axis-cylinders of enormous breadth which appear quite similar to those in Bright's disease.

† Würzburger Verhand. vol. x, page 167.

a vesicular-form nucleus, that he thinks this no longer normal, but is inclined to place it in the same class with the changes in the nerve fibres.

*d.* The walls of the blood vessels, varying in size from small arteries to proper capillaries, were found changed in tracts of various sizes, they were partially irregularly thickened through an homogeneous opalescent mass, which finally occluded the channel completely. In the substance of the walls of some of the vessels dark fatty-like granules were inserted, whose seat did not however appear to be in the epithelium. No reaction was obtained with the iodine-sulphuric acid test.

Müller, however, calls attention to the fact, that a similar thickening and homogeneousness of the walls of the vessels, with a diminution of the lumen, is also met with in other inflammatory processes in the retina, in which we do not suspect any constitutional affection.

*e.* Most extensive heterogeneous deposits of different kinds were found amongst the elements of the retina. In the nests of the hypertrophied fibres of the nervous layer, also between the ganglion cells, but chiefly in the granular layer, numerous granular globules were found, which partly contained largish fat drops, partly very fine dim granules, appearing very dark by transmitted light, but when viewed by reflected light they seemed intensely white. Their form and size varied considerably, sometimes they appeared like small irregular lumps, at others like round cell-like bodies, which were considerably larger than the so-called granules of the retina, and at times even longer than the ganglion cells (0·02—0·03 mm.). Müller thinks that these granular lumps are chiefly composed of fattily degenerated retinal elements; their position speaks against their being larger ganglion cells (although these may also indeed be sometimes fattily degenerated).

*Secondly, extensive masses of evidently new formation were found embedded, especially in the intergranular layer.* The latter forms, its perpendicular fibres being crowded apart, a number of locular compartments, whose diameter may reach 0·2 mm., and which communicate when they are crowded very closely together. They are filled with most polymorphous masses, hyaline globules and drops, which reflect light very strongly, large colloid lumps containing transparent drops, or darkly granulated throughout; others

consist of a confused mass of very distinct small fibres, or a coarse scaffolding of an homogeneous or granularly-striped substance.

The iodine-sulphuric acid test had no effect. They generally resisted, partly very strongly, the action of acetic acid or alkalies.

At one part there was an undoubted relation between these masses and the above-mentioned extravasations, for here and there compartments were found completely or partially filled with blood, which could clearly be seen to have come from the inner layer. It would appear as if sometimes in the hæmorrhagic infiltration of the internal vascular layers the fluid portion alone reaches, through a kind of infiltration, the intergranular layer.

This collection in the intergranular layer, which is most extensive in the neighbourhood of the macula lutea, and diminishes from thence throughout the fundus of the eye, coincides with the normal condition of the retina; for the intergranular layer is particularly developed around the macula lutea, appearing here as a thick layer; and being distinguished by its softness, it allows itself on this account to be easily pushed aside.

In successive sections, Müller was enabled to trace a streak of blood from the neighbourhood of a vessel in the inner layers into the intergranular layer, where it spread out into a largish extravasation. Nearer the equator of the eye these deposits in the intergranular layer ceased, but on the other hand the radial fibres which abut upon the limitans were between the latter and the slight nervous layer, crowded asunder here and there by an homogeneous fluid, so that they appeared to traverse compartments in the form of delicate columns.

At the entrance of the optic nerve an opacity was observed which might perhaps be due to a deposit. At the boundary of the nerve and cell layer a thin opaque streak could (in hardened sections) be observed, in the former it extended somewhat further from the entrance of the optic nerve than the diameter of the latter. The nature of this streak did not appear very clear to Müller. The deposits in the intergranular layer were very insignificant.

The nervous layer was, however, very much thickened, the walls of the vessels were somewhat thickened, even quite into the optic nerve.

Müller regrets that the paper of Liebreich upon the ophthalmoscopic appearances in Bright's disease (Archiv vol. v, part 2), had not appeared at the time of his examination. He thinks that the grey opacity at the entrance of the optic nerve, may be dependant upon the "nerve mass" itself, whereas the "white wall" is for the greater part most likely not only due to the granular cells, but also to the extensive deposits in the intergranular layer described by Müller.