

## **The complications of the cataract operation / by Geoffry C. Hall.**

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Hall, Geoffry C.

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THE  
COMPLICATIONS  
OF  
CATARACT OPERATIONS

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GEOFFRY C. HALL, F.R.C.S. (ENG.)

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PIONEER PRESS, ALLAHABAD.

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THE  
COMPLICATIONS  
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CATARACT OPERATIONS  
AND  
THEIR TREATMENT.

BY  
GEOFFRY C. HALL, *F.R.C.S. (ENG.)*,  
COLONEL, I. M. S.

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# PREFACE.



**T**HIS small work is intended to help the many operators on the eye in this country, as well as elsewhere, who find themselves in difficulties to overcome some of the accidents likely to occur and to raise their percentage of good eyes.

G. C. HALL,  
*Surgeon-Major.*

EYE HOSPITAL ; }  
*Allahabad, 1886.* }



As the demand for this small book still continues I have been induced to republish it.

LUCKNOW : } G. C. HALL, *F.R.C.S.* (ENG.),  
1899. } COLONEL, I.M.S.

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THE  
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CATARACT OPERATIONS  
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**I**T will be advisable, in the first place, in considering the various complications which arise in cataract operations, to divide them into two parts: *first*, to consider the complications which arise during the operation; and *secondly*, those which arise and tend to spoil the success of the operation from one day to three months after the operation has been performed.

In order to thoroughly understand and appreciate the cause of these complications, I will describe Von Graef's linear operation, upper section. I intend to take the parts of the eye actually touched by the instruments,

or which are liable to be so touched, and to give the anatomy and structure of them only, thus enabling the reader to judge for himself of the importance of the various parts, and also to allow him to appreciate the delicacy or otherwise of the various structures which are affected, or likely to be affected, by rough or anything but the most careful handling. It is of the utmost importance that in each stage of the operation the most important structure should be remembered and treated carefully, more or less, as regards its delicacy. With these few preliminary remarks, I will now proceed to describe, first, the operation itself, and then as each part of the eye touched by an instrument is mentioned, to give a short description of its anatomy and also of its appearance in health, and of the various points to be noticed about it, which will enable the reader to judge whether it is in a normal condition or otherwise.

*The Operation.*—Place the patient lying down in a good light, that is to say, in a light which will enable the operator to have a good view of the eye when standing behind the head, and without his own shadow getting in the way (the best light is one which comes from the direction of the patient's feet and shines full

in his face) ; the head is to be slightly raised on a pillow, so that the eye actually faces the light ; the pillow to be flat and not too soft, so that the head will just make a sufficient indent to keep it from rolling over to either side.

Having assured ourselves that there is no sign of any dried up matter, nor streaky flakes of shreddy material on the eye or on the edges of the lids, nor of any matter oozing out of the puncta, we then apply the speculum, for the purpose of keeping the lids apart.

I will now describe the anatomy of the lids as laid down in my programme, and with them will include these important structures, the *puncta lachrymalia* and the hair bulbs.

The eyelids are two thin movable folds which are situated in front of the eye, and have hairs along their free margin, evidently for the purpose of protecting the eye from injury and dust. The upper lid is the larger of the two and the more movable ; it is furnished with a muscle, the *levator palpebræ*, which elevates it, and it is supplied by a branch of the third or ocular nerve. The space between the eyelids when they are open is called the *fissura palpebrarum*, and their angles are called the *canthi* ; the outer *canthus* is more acute than the inner. The inner *canthus* is prolonged inwards towards the nose, and here the two lids are separated by a space called the *lacus lachrymalis*.

There is a small conical elevation at the commencement of the *lacus lachrymalis* on the edge of each lid, the *lachrymal papilla*, the top of which is pierced by a small orifice, the *punctum lachrymale*, the commencement of the lachrymal duct.

This is one of the structures to be carefully studied when the patient is lying down and before commencing the insertion of the speculum. In health it appears as a very minute pin-hole on the apex of the papilla. There should be absolutely not a sign of oozing of any sort out of it. It should be quite clear and sharp cut; the edge should not appear callous or hard, nor swollen. On opening the eye by pressing down the lower lid, then relaxing it, the *lachrymal papilla* should first impinge on to the inner corner of the eye-ball, so as to be able to receive and carry off the tears as they are formed.

There should be no collection of tears in the eye, and if by chance they have collected from the fact of the punctum having been removed from its proper position during the examination, on letting it into its position again, these ought all to be easily carried off; then we know we have a healthy duct to deal with.

The structure of the eyelids consist of (1) *integument*, which is extremely thin and continuous at their margins with the conjunctiva; (2) fibres of the orbicular muscle, which are thin and of the involuntary kind; the use of the muscle is to shut

the lids together, they acting by reflex action from the eye ; (3) *Areolar* tissue, loose and thin, seldom containing fat and very liable to serious infiltrations ; (4) the tarsal cartilages, which tend to keep the lids in shape ; (5) the fibrous membrane of the lids, which act as a kind of ligament for the cartilage ; (6) the Meibomian glands. These last are most important from our point of view ; they number about thirty in the upper lid and are fewer in number in the lower ; they are situated between the fibrous layer and the conjunctiva, and have their openings along the free edge of the lid.

And here it is where their interest to a careful operator is most felt. These openings of the Meibomian glands ought to present a very clear appearance ; they ought to be perfectly free from all signs of pus or other secretion ; they ought not to be too distinct nor yet too dry looking. The use of the glands is to secrete a sebaceous material for the lashes ; but this secretion is normally almost invisible and ought certainly not to be too apparent. The eye-lashes are attached to the free margin of the lid, just in front of the Meibomian glands openings ; they should be curved outwards and upwards in the upper lid, and downwards and outwards in the lower. There should be no hairs turned inwards, and it is always as well to be very careful in examining them, as one hair may escape notice and may do an infinite amount of mischief if not detected and either pulled out or turned into its proper direction. The lower lid



hairs are the ones which mostly cause trouble, and these should be particularly and carefully watched while the patient is blinking the eye, very often the hairs only touching on bringing the lids together. The lower hairs showing any tendency to turn in may be caused by an œdematous or flaccid condition of the lower lid, and this may be remedied at once by painting some collodion over the skin and holding the lid down until it dries, when the shrinkage will act as efficiently as the healthy skin does in a healthy patient. Thus, by taking this small precaution, one of the complications of cataract operations may be at once avoided, as the irritation of the hairs of the lower lid very often sets up a chronic inflammation of the eye and tends to seriously interfere with the progress of the case.

I have now finished the anatomy of the first structure touched by an instrument, and presuming all to be found satisfactory, we proceed to introduce the speculum.

Specula are of various forms; but the great desideratum is a speculum which, while it keeps the eye open and is strong enough to do this against the patient's will, is also so constructed as not to press on

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the eye-ball, while it keeps all the lashes out of the way and affords lots of room for the knife to work in. I shall not describe the various specula, but will only say that Weiss & Co. can supply any one with all that is necessary in that way. The speculum having been applied and screwed tight, we come to our next stage.

*The Fixation of the Eye.*—This stage of the operation will bring us to the conjunctiva, as this is the structure touched by the fixation forceps; but before I describe its anatomy and appearance, I would like to say a few words about the best kind of forceps to use. As there is always, except when a patient is most completely under chloroform, a certain amount of resistance to the drawing down of the eye, on account of its involuntarily being drawn upwards under the upper lid, it is most important that a good strong hold be taken of the eye-ball—one which will enable us to have it under our complete command. This is best accomplished by using a pair of broad-pointed forceps, with at least six teeth—three in either blade. I have found that the four-toothed forceps do not give a sufficiently broad hold, and as, after all, the immediate piece of conjunctiva is only pierced by the teeth, the injury is not much greater with

the six-toothed forceps than with the four-toothed ones. The portion of conjunctive between the teeth does suffer any injury.

The accident most liable to happen, especially with a patient not under chloroform, is that the conjunctiva tears away; and when once this happens it is extremely difficult to keep the eye fixed and the sclerotic fixation forceps may have to be used. Again, if the point of the knife be at all inclined to be blunt, and there is any difficulty in its entering the sclerotic, the necessary counter pressure by the forceps will, to a certainty, cause the conjunctiva to tear, if a good broad hold has not been taken of it. Therefore my advice is always use a broad-pointed pair of forceps and not a pair with only one tooth in each blade or with one tooth in one blade and two teeth in the other, as this is hardly better than the single-toothed forceps.

I will now proceed to describe the anatomy of the conjunctiva and its healthy appearance:—

The *Conjunctiva* is essentially the mucous membrane of the eye; it lines the inner surface of both lids, and is reflected back over the "sclerotic" and "cornea." Its structure varies in its different situations, and its peculiarities according to situation require description, as to the naked eye it appears as quite a

different structure. It may be generally stated that the conjunctiva dips into all the various openings about the eye, and so forms a continuous membrane which lines all the ducts, and then becomes continuous with the skin just as other mucous membranes do. It dips down into the Meibomian glands ducts and into all others which open on to the eye. At the inner angle it forms a fold called the *Plica semilunaris*, which is the red spot seen at the inner corner of the eye. The fold formed by its reflection off the lids on to the eye-ball are called the superior and inferior palpebral folds, respectively.

The conjunctiva on the inner surface of the lids presents an appearance of being covered with numerous papillæ, which are points of great interest to us, especially if they are at all inclined to be granular or raised and hypertrophied. We should carefully see that these granulations are not present at the time of operation. I will, however, say more on this point when we come to the cornea, inasmuch as these granulations, when serious, always leave their mark on this structure. The conjunctiva folds over on to the sclerotic, and here it assumes quite a peculiar character; it becomes much thinner and much less vascular, and in the perfectly healthy eye is almost white, there being only a few vessels apparent in it. It, however, becomes distinctly vascular on the very slightest provocation. It is a moderately tough membrane, but tears easily if caught hold of with a too finely pointed forceps. It

passes from the sclerotic on to the cornea, and here again it changes its structure, becoming absolutely bloodless, no vessels being traceable into it; its blood supply coming from the vessels in the sclerotic. Blood vessels do, however, exist in it as they become apparent under certain diseased conditions.

The healthy conjunctiva, as will be seen from the foregoing description, requires to be carefully studied, and presents varying appearances in different situations. The under surface of the lids should be glistening and smooth, there should be no roughness apparent, the eye-ball should look white and blanched, there should be absolutely no secretion nor flakes of stringy matter apparent anywhere, nor should there be any pimply-looking points, called *Pingueculæ*, standing out from the sclerotic.

The fact of a growth, *Pterygium*, which is a thickening of the conjunctiva, being present, does not render the eye a bad one for operation, provided it is first cut off. If allowed to remain, it is apt to drag upon the lower portion of the eye and so cause a gaping of the wound, or, if the wound is not actually pulled apart by it, it is very apt to cause the cornea to wrinkle and so

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interfere with good vision, by causing an astigmatic condition of the cornea. The condition of the cornea should be studied very carefully at the same time; the cornea should present a perfectly clear, smooth, transparent appearance; there should be not the slightest sign of points upon it, nor should there be any roughness; there should be an entire absence of apparent vessels, no milkiness, except it is of old standing, which can be at once recognized by the sclerotic not showing any signs of recent inflammation. If there are any opacities of the cornea, they must be of old standing, as can be judged both from questioning the patient and from the general appearance of the eye. Any ulceration should carefully be looked for, and any appearance of pin-points or roughness should at once lead to an examination of the inner surface of the lids, to see whether they are healthy or not.

The appearance of a white ring round the edge of the cornea, known as the *Arcus senilis*, which consists of a fatty degeneration of the cornea, does not of itself render an operation unadvisable as very many patients suffering from cataract present the appearance; and as it is more or less a natural change due to

age, it cannot be either treated or avoided. I have never found that eyes with *Arcus senilis* are slower in healing than those without it, so I think we may pass it over and consider that if the cornea otherwise seems pretty healthy the operation may be proceeded with. The other appearances indicating active disease, however, should make a postponement of the operation advisable, and on no account should any eye be operated on which presents a cornea with active ulceration or sign of inflammation, no matter how small the ulcer or how slight the inflammation. The elasticity of the cornea can be judged by pressure with the finger, as also its thickness or the reverse, and a thin flaccid cornea should, if possible, be treated by putting the patient under a tonic treatment for a month or so, and getting him into as good a state of health as possible.

If a leucoma or white patch be present, evidently of long duration and with entire absence of sign of inflammation, then the iridectomy and the incision should be made at the clearest portion of the cornea, so as to allow of the most light entering the eye. Often cases present themselves in which the incision has to be made

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at various angles ; no fixed rule can be laid down but each case must be treated on its merits.

It is much better to prepare an eye with a suspicious-looking cornea, than to operate on it at once with a bad prospect of recovery. As I have said before, the forceps used should be capable of taking a good firm hold. Having pinched up a good broad piece of the conjunctiva, and drawn the eye gently down so as to expose the edge of the cornea, the next and the most important part of the operation commences. Holding the narrow bladed knife between the index finger and thumb, lightly, but yet firmly, having first tested its sharpness by passing it through a thin piece of kid skin, which can be obtained from any good instrument maker, a drum to hold it tense being also supplied when wanted, and having thus found that the knife is a perfectly sharp one, it must be passed in with the cutting edge upwards and slightly forwards so as to give a very slight direction forwards to the incision.

The exact place of entry of the knife is important, and varies with different operators. A very good rule is to take a point in a straight line with the outer edge



of the cornea, and another with the upper edge, and to pass the knife in where these two lines meet, draw an imaginary square round the cornea, and so pass in the knife at the upper outer corner of this square, and then straight across the anterior chamber, to make it come out at the same point on the opposite side, that is, at the inner and upper angle of the square. This is a very good rule to follow, and will give an incision just at the junction of the cornea and sclerotic. I will return to this part of my subject after I have given the anatomy of the part of the eye now touched by the knife. First, it pierces the conjunctiva and then the sclerotic. I will, as some operators make their incisions entirely in the cornea, include these two structures in my description of the anatomy.

*The sclerotic* is the dense, unyielding, white, fibrous membrane which forms the actual bulwark of the eye. It is very tough, and to it are attached all the external muscles, and the various internal structures are more or less intimately connected with it, it being the woodwork to which all the bricks of the building owe their support. It serves to maintain the eye in shape, and is thicker behind than in front. It is of a white colour, all except the front where it forms the cornea. Its inner surface is of a brownish colour, being covered with a peculiar pigment, and is grooved for the ciliary nerves and is connected with the outer surface of the choroid by a fine cellular tissue called the *lamina fusca*. It is continuous behind with the fibrous covering of the

optic nerve, and forms, as it were, an expansion of the end of this nerve. The optic nerve itself enters the sclerotic at the back, somewhat to its inner or nasal side. The part where it enters is called the *lamina cribrosa*, being a sieve-like thinning of the walls, the nerve fibres passing between the divisions of the sieve and passing forward on the inner surface of the choroid to terminate in front near the suspensory ligament of the lens. The fibrous divisions which separate the nerve fibres of the optic nerve where it enters the globe are formed from the fibrous sheath which divided these fibres in the nerve itself before it entered, again showing that the sclerotic is simply a thickened termination of the fibrous covering of the optic nerve.

Around the cribriform opening are several small openings which allow of ciliary vessels and nerves entering. The sclerotic in front continues without any break of continuity into the cornea, but the opacity of the fibres continues over the cornea rather more on the outer than inner side. There are not many vessels in the sclerotic, nor have nerves been satisfactorily demonstrated in its structure; all the same, there is a good deal of sensation in it, as may be seen in cutting it; this may, however, be due, and most probably is to the other nerves which necessarily must be cut in passing a knife right through it.

The knife in passing into the anterior chamber touches first the conjunctiva, then the sclerotic and internally, as it enters the anterior chamber, and comes into contact with the aqueous humour, it cuts the internal surface of the sclerotic with its nervous structure.

I will take these structures seriatim, and consider them all together, as it is impossible to separate them. The conjunctival apithelium covers the front of the cornea and consists of thin layers of transparent nucleated cells, the deeper being perpendicular to the surface, the upper ones more horizontal.

The cornea, which in some cataract operations is the only structure cut, comes next. The cornea forms the transparent clear front, one-sixth, of the eye-ball. The structure of the cornea consists of the following coats, the *anterior elastic lamina* which is a perfectly homogeneous membrane of very great thinness ; it is very elastic, and curls up when detached from the cornea proper or middle coat. Its use is supposed to be to keep the cornea in its proper shape, and allowing it a certain amount of elasticity, and of its regaining its shape if interfered with in any way, as by a blow on the eye, elasticity being in the eye a great safeguard against injury. The next coat is what is known as the proper substance of the cornea, and is an absolute continuation of the sclerotic. The fusiform cells of which it is composed are arranged in laminæ superimposed on one another, all of which have the same direction and are united at various intervals.

These laminæ are very interesting to the Ophthalmic Surgeon, from the fact that pressure either from within or without tends to alter their relation to each other, and to cause a diminished transparency in the appearance of the cornea, as may be witnessed in a case of glaucoma with very much increased tension.

The cornea does not possess any vessels proper, but there is always an amount of fluid contained between the laminæ which no doubt is for purposes of nutrition. Behind, the cornea proper is covered by the structure exactly similar to the anterior elastic lamina, called the posterior elastic laminæ, and this being elastic acts in the same way in tending to keep the cornea in shape.

The next coat is the epithelial lining of the anterior chamber ; it consists of a single layer, of polygonal transparent nucleated

cells similar to those lining other serous cavities, and these most probably have the same properties. The cornea gets its blood supply from the capillary vessels, which terminate in loops at its edge. The nervous supply is large, being derived from the ciliary nerves which ramify through the laminated structures in a delicate network.

The next structure of the eye brought into contact with the knife as it passes through the sclerotic or internal coat of the cornea is the aqueous humour.

This watery fluid, which consists of little else than pure water having a little chloride of sodium in solution, fills up the entire space of the anterior chamber, which is the chamber to which the point of the knife has now arrived. The anterior chamber is bounded in front by the cornea and behind by the ciliary ligament and front of the iris, and now I will describe these two structures, as it will be seen how important a bearing they have on the operation. For instance, if the knife is entered too far back it will cut through the ciliary ligament, and this being injured, is one of the very many complications which so often arises in cataract operations, and which tends to mar the results.

The *ciliary ligament* is a narrow ring of circular fibres of a whitish colour about one-fortieth of an inch thick; it serves to connect the external and middle tunics of the eye, is placed round the circumference of the iris at its point of connection with the external layer of the choroid, the cornea, and sclerotic—just behind, in fact, the point of entrance of the knife as previously laid down. Its component fibres are delicate and very much like elastic tissue. At its point of connection with the sclerotic there is a small canal called the *sinus circularis iridis*. It is the division of this canal which is important to be avoided among other points of importance of not injuring this ciliary ligament; the ciliary nerves and *vasa vorticosa*, or choroidal

vessels, also run right up to the ligament, and are so intimately connected with it in their termination, that to cut the one means to injure the other.

The *ciliary muscle* again lies just behind it, and may also be included in the incision if too far back. The muscle consists of unstriped fibres and forms a band about one-eighth of an inch broad on the outer surface of the front part of the choroid. Its fibres are soft, longitudinal in direction, and arise at a point of junction of the cornea and sclerotic just behind; passing backwards they are attached to the choroid and touch the retina by their inner surface at the folded part of the choroid. This is a most important structure to avoid wounding, and it is only by keeping well in front of the iris at its attachment that it can be avoided.

Any entrance of the knife too far back will almost certainly cut it, and with its numerous blood and nervous supply, and its folded delicate structure lead to inflammatory results, which will by its continuity with choroidal tissue and iris on their side be most disastrous; so its situation must be carefully borne in mind, and it must be as carefully avoided as though it were quite apparent to the eye of the operator. The knife in passing across the anterior chamber which it has now entered, is to be kept perfectly straight and parallel to the iris so as to avoid wounding it; and also to as equally avoid piercing the cornea in its passage. This is managed by keeping the fingers securely pressed against the side of the orbit to give the

hand a good support, and by watching the point of the knife as it crosses in front of the iris, it should then be made to emerge at as nearly as possible at a point situated on the same level on the inner side of the cornea as the point it entered on the outer side, that is to say, at the opposite angle of the imaginary square. Once the transfixure is complete, presuming that nothing untoward has occurred during its passage, the next step is to cut directly outward and slightly upwards, so as to give the incision a slight slanting direction, which will enable the lens on being pressed from below to meet with least resistance, this being the natural direction it will take, as the lower edge being pressed inward will cause the upper edge to tilt slightly forward. The incision should be completed by a slow backward and forward cutting motion of the knife, and if the conjunctiva shows a tendency to be tougher than usual and is inclined to be raised off the eye, it should be very gently pressed by the knife so as to cut it without detaching it.

Now, if, during the passage of the knife, the iris is accidentally caught, and if by gently withdrawing the point, and again endeavouring to pass it or clear the

iris, this still shows a tendency to fall forward on to it, the best thing to do is to cut straight on making for the point of exit as before pointed out, and cutting outward as before. The cut portion of the iris will be eventually cut off, and will not have any bad effect except the piercing has taken place too far back or too low down.

If, on the other hand, the point of the knife is found to pierce the cornea at any point so that by continuing the passage it would emerge at a point too near its entrance, it must be instantly drawn back, and having been disengaged be passed on to its proper place. If this is not done, the incision will prove to be too small and will require enlarging with scissors, which is always a bad business, the point of the scissors being more or less out of as much command as the point of the knife, and again the insertion of the scissors is always attended with more or less risk, so, if possible, try and avoid having to use them. However, if it is found on trying at a later stage to press the lens out that it will not easily emerge, always use the scissors to enlarge the opening, and do not use any extra force to squeeze the lens out. The scissors may do harm, but are not so

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likely to certainly injure the eye as the squeezing a large lens out of a small opening will assuredly do.

Accidents, such as piercing the capsule or dislocating the lens, ought never to occur ; but if they do, the best thing to do is to complete the incision as if nothing had occurred. But if the lens has been seen to disappear from its place behind the pupil leaving a clear pupil, then withdraw the knife and trust to its having taken up its abode in the vitreous at some point removed from the contact with the retina and choroid, and let the case remain for further development. If the eye shows any signs of inflammation later on, then it will require to be dealt with as will be described further on, if not the patient will have good sight and the case will have resolved itself into one with a couched depressed lens. To attempt to remove the lens will almost certainly bring failure, and an iridectomy will not at the time be of any advantage as the round pupil is much more useful.

I mentioned at the beginning of this chapter that the direction of the edge of the knife must be carefully seen to. If by oversight you find that you have introduced the knife with the cutting edge downwards,



instead of upwards, withdraw it at once, and closing the eye up, leave the patient till next day so as to allow the aqueous humour, which is sure to escape by the withdrawal of the knife, to reform. The wound made by the knife will not hurt the eye or lead to any bad result, whereas if you again tried to pass the knife in with its edge the right way up, the loss of aqueous humour would most certainly cause the falling forward of the iris and might lead to a bad result.

Occasionally it happens through straining of a patient not under the influence of chloroform that the skin of the lids is pressed upon the knife after it has emerged and is lying across the anterior chamber. To complete the incision with this abnormal director acting on your knife, will most probably cause the incision to be jagged, that is, the edges of the wound will not be a straight line, and the direction of the upper and lower edge will vary. When this happens get an assistant to draw the skin away so as to free your knife, and then complete the incision as quickly as possible. This is only likely to occur when your speculum is a weak one.

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If the eye-lashes are in the way, cut them off before beginning, as if they do not do more harm by being cut by your knife, they will most certainly blunt it.

There are no more complications likely to arise at this stage of the operation, which, when completed, leaves the eye with the opening for the exit of the lens made and the iris projecting through it, it having fallen forward the instant the aqueous humour escaped.

Now, we proceed, having released the eye from the fixation forceps, to the next stage, namely, the making the iridectomy. In this stage the part in contact with the instrument will be the conjunctiva, already described, and the iris, which will now be described.

The *iris*, I may now mention, is the most important of all the structures concerned in the linear operation, as on its proper and careful treatment or the reverse depends the final result of the case, so that we cannot be too careful of it. The iris consists of three layers: an anterior or fibrous layer, a middle or muscular layer, and a posterior or pigmentary layer. It is situated just in front of the anterior capsule of the lens, where it hangs like a curtain. It contains an opening slightly to its nasal side, called the pupil, which admits the light to the back of the eye. It is intimately connected with the choroid behind, the colouring matter being absolutely continuous with the colouring matter of the choroid. It forms part of the

posterior boundary of the anterior chamber ; its two surfaces are flat and look directly backwards and forwards. The anterior, or fibrous layer, consists of delicate fibrous stroma interlacing, among the interstices of which are situated the colouring matter which gives the colour to the eye, also the nerves and blood vessels ; the latter coming from the long and anterior ciliary arteries and from the vessels of the ciliary processes, so that it will be seen that the iris is very freely supplied with blood, there being a complete vascular circle round its outward circumference. The nerves are derived partly from the third nerve and partly from the sympathetic. The middle or muscular layer is made up of two kinds of involuntary muscular fibres—the circular, which surrounds the pupil, and the radiating, which radiates from the pupillary fibres to the outward circumference. The circular fibres form a band about one thirty-second of an inch in width. Those near the margin are very closely approximated ; those towards the outer sides more widely separated. The radiating fibres converge towards the pupil from the circumference and mix with the circular fibres. The circular fibres are supplied with nervous power by a branch of the third nerve, which is conveyed to it through the lenticular ganglion. The radiating fibres are supplied by the sympathetic fibres of the same ganglion. The posterior or pigmentary layer is composed of several layers of small round cells filled with pigment of a dark colour. This is continuous with the pigmentary layer of the ciliary processes, and that of the choroid.

The body of the iris is very liberally supplied with blood vessels and nerves, these being the cause of its extra sensitiveness, and the free blood supply will at once allow us to see how important it is to deal gently with it, as its very fine netlike structure tends to raise its delicacy and to make it resent anything approaching

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rough handling, such as, squeezing, bruising, or tearing. Sharp cutting does not tend to inflame it, but the least pressure or bruising or tearing will most certainly cause it to inflame and pour out from its vessels inflammatory lymph, which, as I shall afterwards point out, is the natural enemy of the Ophthalmic Surgeon. The incision being completed, and the eye having been released from the fixation forceps, they are again to be taken up and the eye again seized, and here I will mention one most important point, always to seize the eye at the same point on each occasion of releasing and again having to fix it. This seems only natural, but it is not always done, and is most important. Seizing it then in the same spot as before, have the eye drawn down by an assistant if it shows any tendency to roll up under the upper lid, if not there will be no necessity to fix it ; but the next stage of the operation may be commenced : this is the performance of the iridectomy. The iris will, as a rule, be found lying at the mouth of the incision, presenting a bulging appearance, but occasionally it does not present, and the pupil can be seen just as it was before the incision was made. If it presents, it should be carefully

taken hold of by the iris forceps, which are made of two kinds, curved and straight. Either will do, but the curved are the best to use when the iris does not present fully; but if lying quite outside the incision, the straight forceps will be found the best.

The iris having been gently taken hold of, and (here I may mention that the iris forceps, being very delicately made, will not allow of much pressure being made on them, or the points will cross and not take hold at all) it should be very gently and delicately drawn out, and the scissors open, passed behind, being careful to keep the back close to the sclerotic, and the piece should then be cut off very carefully, beginning at the angle of the wound and following the curve of the eye ending at the opposite angle of the incision. This is necessary to prevent the uncut portion from remaining in the wound, as if the curve of the eye is not followed, but a straight cut made across the two ends will remain projecting, and will be caught by the wound in healing.

Very frequently, after the piece of the iris is cut off, the whole anterior chamber becomes filled with blood,

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obscuring the view of the state of the affairs completely. All that is necessary in this case is to press from below in an upward direction, with the curette end of the pricker, and thus to squeeze the blood gently out of the way. If it shows a tendency to return quickly, then the operation must be proceeded with at once, and the lens capsule opened and the lens extracted, as will be described further on.

I will now proceed to describe the accidents liable to happen during this part of the operation, and the appearance of the iris which shows its healthy condition, or the reverse. When the iris protrudes, as it generally does, it is well to seize it firmly and to draw it out well, so as to ensure cutting a segment of the pupillary edge. This is easy in this case, but where it does not show a tendency to protrude, there is always a danger of not sufficient having been drawn out, with the result that after the piece has been cut off of finding, that the piece has not included the pupillary margin, and a bridge of iris is seen stretching across. If this is very narrow, it is best to take no notice of it, but to proceed to prick the capsule and trust to the exit of the lens to break it down. If, however, it is found to be of

any breadth, it should be carefully taken hold of with the iris forceps and cut off.

The reason of this advice is that the iris stands cutting very well but not tearing, and any large portion of it which is torn will certainly resent it and set up inflammatory action. Always then try to avoid leaving this bridge, by being careful to see that the iris is sufficiently drawn out to include its pupillary border.

The complication just mentioned occurs from too delicate handling. Let us now see what is liable to happen if too much force is used ; in this latter case the iris is liable to be torn away from its attachment. This is an accident which, though generally of very serious moment, does not always tend to a bad result, though always setting up inflammation, and the best thing to do is to see that no tags of torn iris remain in the wound ; look carefully for them, and if found cut them off, finish the operation, and apply atropine, and if you have the instrument at hand apply the artificial leech, which, by its sucking action, will tend to draw the blood away and avert the inflammation which is threatening, or will at all events tend to lessen its

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severity. I have myself saved eyes in this way, and I consider that it is most important to apply the leech at once on seeing that the iris has been torn. In cutting off the piece it is a very common complication to find that the edges of the wound get in the way, and it is necessary to be very careful not to cut off a piece of the cornea at its cut edge and to include this in the cut off iris, as it sets up an inflammatory condition of the eye and tends very much to retard recovery. Sometimes the inflammation passes on to the iris and other internal structures, although the ultimate result of the case will most probably be unaffected. When the iris has been seized by the forceps in a patient not under chloroform, and the eye not held by an assistant, it occasionally happens that it is suddenly rolled up under the lower lid, out of sight; this may occur before the scissors have commenced cutting it or just as the first snip is made; in any case, the best thing is to at once release it and to get the eye pulled down. Never try to complete the cutting while the upper lid is in the way, as it will always be found that the piece cut off is too small, or that tags are left at either end of the wound.



As I have said before, we are now dealing with the most important structure concerned in the operation, and although I may appear to have laid too much stress on the complication, yet no after treatment will compensate for any injury which the iris receives at the time of the operation. The doing an iridectomy was for the express purpose of not bruising the iris during the exit of the lens, and it is only by being extremely careful that we can avoid doing this while operating on it.

With regard to preparing the iris for the iridectomy, I advise eserine being instilled about quarter of an hour before commencing, as this will tend to draw it away from the wound after it is cut ; atropine used to be used for the same purpose, but it will always be found that immediately the incision is made, the pupil contracts to its normal size or very nearly so, whereas with a contracted pupil the contraction continues from the action of the circular fibres, or want of action of the radiating fibres.

The most modern theory regarding the drugs atropine and eserine is that they both act on the circular

fibres only, the atropine paralyzes these fibres, whereas the eserine stimulates them. The action of atropine, therefore, is to paralyze the circular fibres, and this allows the elastic lamina of the iris to act and thus open the pupil; eserine, on the other hand, stimulates these circular fibres and causes the pupil to contract. The action of the radiating fibres in causing the pupil to dilate is denied. One point of importance, if this theory is correct, is that it is evidently useless using very strong solutions of atropine, as once the circular fibres are completely paralyzed, the drug has done all it can, and it is dangerous, in trying to make it do more, by employing stronger solution, hence 4 grains to the ounce should never be exceeded.

I do not want to be understood that atropine action entirely ceases after cutting the iris, but that eserine continues to act more strongly and does what is required more thoroughly. Again, I fancy that from the stretching of the radiating fibres, the larger portion of the cut edge of the iris is to a certain extent constricted, and this tends to lessen the liability to bleed and to throw out lymph, which, as I have said, is our natural enemy when poured out inside the eye in any quantity.

With regard to the appearance of the iris before operation, it should present a clean, clear colour ; there should be no dirty, dusky look about it ; the reticulated structure should be quite apparent, and chief of all favourable signs looked at should be the vitality of the pupil. The eye should be frequently opened and closed, or the hand placed over it and again sharply removed and its appearance watched. The quicker it responds to the light the more favourable promises to be the result, and if the rest of the eye looks healthy it should certainly be a good case. The edge of the pupil should be quite free ; there should not be any attachment to the front of the lens capsule ; if any are apparent, as may be seen by irregular dilatation of the pupil, then atropine should be instilled, and after its action has dilated the pupil, the attachment can be more clearly seen. If possible, the operation should be commenced opposite the part attached, so that after the iris is drawn out these attachments may be torn off and then the torn pieces moved.

In performing the iridectomy, if the free border is cut off, the lens capsule will remain attached, and will, if no worse result follow, obscure the vision ; the

presence of the capsule always gives the lymph thrown out a something to cling on to and prevents it getting absorbed. Were it simply the presence of the capsule, this could be overcome by an operation at a later period; this operation will be described further on.

The pupil should be carefully scanned as to its size, a large pupil always causing a suspicion of extra internal pressure, and my advice is, with a large dilated pupil, to always perform a preliminary iridectomy, and then a fortnight afterwards to remove the lens; but do not risk the eye by removing the lens at one operation. The iridectomy having been duly done, we now pass on to the next stage of the operation, the opening of the capsule; and I shall first describe its anatomy and then give a few hints as to how it should be opened. Some operators try to remove the lens and capsule entire; but there are objections to it, and, as I think I shall be able to show how the capsule can invariably be extracted, I do not intend to allude to the extraction of the lens with the capsule intact but to describe the operation of opening it and then extracting it with the lens.

The *Lens Capsule* is a clear, transparent, very elastic membrane. It is very brittle; its elasticity causes it to curl up

when torn. It surrounds the lens and lies behind in a depression in the vitreous humour of the eye. It is kept in its position by the suspensory ligament, which is situated just behind the outer margin of the iris. The capsule is much thicker in front than behind; no vessels are traced to it in the adult, but in the fœtus a small branch from the arteria centralis retinae supplies it with blood.

The *Suspensory Ligament* of the lens is a thin transparent membrane, situated between the vitreous humour and the ciliary processes of the choroid; it tends to keep the lens in its place. Its external surface consists of a lot of folds into which the folds of the ciliary processes are received. These folds are arranged in a radiating manner and are stained with pigment, being of a brownish colour. The suspensory ligament consists of two layers, the external and internal; the external a tough granular membrane, the internal a clear transparent structure. The posterior surface of the internal membrane is turned towards the hyaloid, being separated from it at the outer edge of the lens by a space called the Canal of Petit.

The healthy appearance of the capsule is that it should be clear without white spots on it, but as far as making any difference in the result, it does not matter much as to its condition, as the end and aim of the operation is to extract it, and the fact of chalky spots, although showing old standing disease, rather renders it more apparent, and, therefore, easier to extract should it be left behind when the lens is extracted.

The eye should be again seized and fixed, and the pricker passed into the incision with the point turned

sideways ; it should then be passed on until it reaches the lower edge of the pupil, and then turned so as to bring the point towards the lens. A slight incision should then be made, very great care being taken not to dislocate the lens. It should then be withdrawn, and the next part of the operation, namely, the exit of the lens, proceeded with. If the lens is seen to be depressed by too forcible an attempt to rupture the capsule, as may sometimes happen when the pricker is blunt, every attempt should be made to extract it, as the operator having arrived at this stage, it is imperative that the lens must come out, and by using a scoop made for the purpose it can usually be caught and withdrawn, the capsule being ruptured and the soft matter of the lens having escaped.

If the lens is left and not extracted, the inflammatory results will be most destructive, so that this accident is always a very serious one and places the eye in great jeopardy. It may occasionally happen that the lens disappears entirely with its capsule, leaving the pupillary opening clear ; then, as I said before, leave it alone, but if apparent, extract it. Now, as to the reasons I have for always passing the pricker on to the lower

edge of the pupil. The lens capsule is a very elastic membrane and curls up on itself at once when ruptured. If the rupture is made at the lower edge, it curls upwards, and the lens on its emerging pushes the curled-up capsule with it. This, then is the great secret of getting the capsule out with the lens without having to enlarge the incision so as to admit of its exit entire; when the capsule is ruptured as described, the soft matter oozes out of the opening and the bulk is much smaller. The oozed out soft matter can then be coaxed out after the lens has been extracted, and as it has nothing to stick to, it comes out very easily. I am certain that my readers will, if they try my plan, increase both their averages of fairly good eyes and the acuteness of vision in their very good cases.

In addition to the dislocation of the lens, an accident or complication liable to occur at this part of the operation is wounding the iris or the back of the cornea with the pricker. This may happen if the operator be not particularly careful to watch the point of the instrument as it passes beneath the cornea, or if the anterior chamber is filled with blood which obscures the view. If either of these accidents occur, the

best plan is to proceed as usual and instil atropine and apply the artificial leech so as to meet the threatened inflammation and to lessen its intensity. The iris stands tearing almost better than it does pricking, and the cornea is very sensitive, and if the posterior elastic lamina is disturbed will quickly resent it.

We will now pass on to the last stage of the operation, and as the lens is now the structure we arrive at, I will first give its anatomy and then describe how it can be most easily extracted. There are more complications likely to arise here with a new operator than almost at any other part of the operation.

The *Lens* is situated in its capsule surrounded by soft matter varying in quantity and quality. As in the extraction of cataract the diseased lens is the object of our operation, it is the diseased and not the healthy lens that I shall describe. The varieties of cataract met with all depend on the changes which have taken place either in the soft matter or in the centre of the lens. The substance of the lens consists of fibres, and an interstitial substance—a semi-fluid material occupies all the interstices, and in the centre or nucleus of the lens, these are only more closely approximated. In health, all is clear and transparent; in disease, one or other part begins to get opaque. The outer portion of the lens substance is called the cortex. There is, as I have pointed out, however, no distinct margin between the nucleus and cortex.



The chief forms of cataract are the following:-- The nuclear, cortical, and the mixed, the other varieties being more or less variations from one of these, and are not of sufficient importance, from an operator's point of view, to warrant a description, as these great varieties include all parts of the lens.

*Nuclear Cataract* may be generally recognized by its yellowish discoloration; it commences in the very centre of the lens and may mature very rapidly, or it may remain immature for years, causing an obscurity of vision as though the patient were looking through a piece of dull coloured glass. The colour varies, being sometimes white, or it may be in cases quite black, constituting white, brown, or black cataract. This is supposed to be due to blood effusion and colouring matter. This form of cataract may appear at any age, depending on some of the unknown causes of the disease.

*Cortical Cataract* commences by streaks of opacity usually beginning at the outer circumference of the lens under the cover of the iris, which must be dilated to see them, the centre remaining clear till these streaks have further encroached on it, which they usually do in

about two years from the first appearance, but occasionally longer.

*Mixed Cataracts* consist of all the various varieties in which both cortical and nuclear substances are involved, and are of very many kinds. The *Congenital Cataract* usually consists of this variety, and as in youth the centre is softer and less distinguishable from the cortex, it can be easily understood that no great difference can be traced as to the point of origin of the disease. The *Anterior and Posterior Polar Cataracts* are varieties which are so named as the disease begins in the anterior and posterior pole of the lens. The *Lamellar* is so called on account of its presenting an appearance of the opacity being confined to the lamella immediately beneath the capsule, being as it were in layers.

All the different varieties, however, require the same treatment, the only one which is to be carefully looked for is the *Morgagnian Cataract*, one in which the soft matter has become quite fluid. I will now describe the soft matter as it usually appears in cataract, and then point out the difference in a Morgagnian Cataract. The soft matter is usually a very sticky

creamy material, consisting of the altered clear cortical substance of the lens ; it has a very great affinity for the inner surface of the capsule and if not all opaque will show a tendency to remain behind, being invisible in the eye after the opaque matter has been squeezed out. In about 24 hours, however, it shows itself by getting opaque. The soft half opaque matter of the lens resembles very much in its inclination to stick to the inner surface of the capsule the soft matter inside a grape, which, without squeezing the two sides of the skin together, it is quite impossible to clear out entirely. The nucleus on its exit always has a certain amount of soft matter sticking to it. In the Morgagnian Cataract, however, a very great change takes place, the soft matter and the nucleus dissolving partnership and becoming two distinct substances. The soft sticky semi-consistent matter has become quite fluid, and the nucleus, a hard yellowish double convex lens, small, as a rule, and very easily extracted. On rupturing the capsule, the milky fluid comes out and leaves the small hard centres behind ; on applying slight pressure this comes out, and if the pupil presents a clear black appearance, as it usually does, the operation is over. The

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capsule in this case being very invisible and having curled itself up out of the way, does not require any further interference.

This then is the great importance of the Morgagnian Cataract, that for a case diagnosed before extraction the incision may be very well made much smaller than for the other forms of Cataract. The Morgagnian Cataract may be generally recognized by its milky white clear appearance and occasionally the nucleus can be seen floating in the fluid cortical substance, but any cataract which presents an appearance of a distinct yellow centre with opaque white all round, the yellowness being at the centre only and the whole appearance being clean and clear, may be almost certainly diagnosed as a Morgagnian Cataract. The size of the nucleus should guide us as to the size of the opening necessary for its extraction; and this can usually be diagnosed by a careful examination; when the entire lens appears of a dark yellow colour darkening towards the centre, we may know we have a large nucleus to deal with and *vice versa*.

The capsule having been ruptured, we now again fix the eye, and taking the curette in the right hand, press

gradually and gently from the lower margin of the lens that is, just about the position of the lower edge of the pupil, press very gradually, and as the lens is seen to emerge, gently continue the pressure higher up, following the lower edge as it retreats from under the curette. After the lens is out, gently stroke the cornea upwards and try to coax out any soft matter which may be seen remaining behind, vary the direction of the pressure; if, for instance, soft opaque matter be seen to the right side, then press gently from this side. Now, as to accidents liable to occur at this stage, they are, first, by too great pressure being exercised, it may happen that the expulsion of the lens is followed by a gush of vitreous; this is a bad accident, when too sudden, as the removal so quickly of the support of the retina may cause it to become detached; then, again, it may lead to hæmorrhage inside the globe. Again, the curette may injure the front of the cornea and set up keratitis or inflammation of this substance; it is, therefore, always as well to moisten the front of the cornea with fluid from the corner of the eye or lower lid, especially when operating in hot weather. Secondly, the lens may be broken up and come out in pieces; this is generally due

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to the opening being too small ; in this case pressure should be stopped at once, and the pieces removed with the scoop gently inserted behind each piece. On the lens and soft matter being removed, there still may be an absence of the black clear pupil so desirable, and this will be due to the presence of the capsule with some soft matter attached to it.

This is a most important structure to remove, but it should always be carefully taken into consideration that the removal may cause more injury to the eye than its presence, and if the operation has gone off very successfully with no untoward accidents, a few attempts may be made with the iris forceps to remove it. If after the two or three attempts to seize it, it appears to be closely adherent to the inside surface of the cornea, then leave it alone for future treatment. By turning down the points of the iris forceps it can occasionally be ruptured, and disappearing under either side of the iris may then be left, as it will do no farther harm. Nothing can do so much harm as persistently fishing for it with the forceps, which it can be seen through the cornea fail to secure it, rather trust to its being torn by a future operation after all signs of inflammation have ceased.

We have now extracted the lens, and the next thing to do is to thoroughly clean the eye by wiping away all the blood which may have collected at the corner and under the lower lid, then to apply a light compress. This compress may be either wet or dry and should contain some antiseptic. The compress should be made of soft cotton wool which has been soaked in a solution of carbolic acid, 1 in 60, or boracic acid of the usual strength, and then dried, if it is preferred to use a dry compress; if a wet one, then it is to be soaked at the time of the operation and applied at once, after being gently squeezed. The cotton wool is placed between two layers of thin muslin and cut into the shape of a semi-circle and applied with the convexity downwards, thus allowing it to fit into the shape of the orbit.

I advise a wet compress being used, as I have found since I used it that I have not had a single case of panophthalmitis or inflammation of the eye following an operation. A bandage is then to be gently but firmly applied over the compress; the bandage most convenient is the triangular one as shown at the end of this book. It can be used either as a single or double

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bandage, and when as a single one has the advantage of leaving the other eye free.

We have now finished the first part of the subject, and will pay imaginary visits to our patient to see day by day for the first week how he is getting on.

*1st day.*—On seeing the patient if we find he complains of no pain about the eye, ask how he has slept; whether he has any sensation of pain about the forehead; if he says no, then leave the bandage just as it was, and the prognosis of the case may be considered very promising.

If he complains of pain about the eye, open the bandage at once and remove the pad, and having done so carefully, scrutinize the appearance of the side of the pad where it touched the eyelids, also the lid itself, especially the upper lid. If the pad shows any signs of pustular matter and the lid seems at all swollen, then open the eye, and look carefully at the pupil as quickly as possible, take the state of affairs in at a glance. Should the conjunctiva be very much swollen, and the pupil present a dirty-looking appearance and the wound itself look yellowish, you will then have a case



of threatening panophthalmitis, and it will, if left to itself, go from bad to worse ; the fact of having found pustular-looking matter on the pad will show that there is pus being formed. The pad is now to be left off, and more stringent measures taken to ward off the threatening destruction of the eye.

Get a drachm of belladonna extract and mix it with an ounce of water, have it boiled and apply it on cotton wool as a fomentation at once, keeping it applied for at least two hours.

Apply the artificial leech to the temple and take away about two ounces of blood, or if you do not possess this instrument, apply leeches to the temple—four will be sufficient ; administer a purgative draught of Sulphate of Magnesia, and repeat the fomentation till all pain ceases. In this way many an eye can be saved, which, if treated less vigorously, would most certainly become destroyed.

*2nd day.*—If there is no sign of pain, merely remove the pad, and if it does not present an appearance of copious discharge or discharge of pustular matter, keep the eye closed and apply a fresh pad. If, however, as

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in the former day's visit, an unpromising state of affairs is found, then, immediately open the eye and see what is the cause of the apparently approaching inflammation. This, in the second day, may be either due to iritis supervening, or to the presence of soft matter, which may have been left behind at the time of the operation, this being more likely to be the cause of the bad symptoms from its having become swollen from proliferation of the cells added to the fact that lymph which has been poured out from the cut edge of the iris has become attached to it.

The soft matter will be at once apparent by the bluish white appearance of the matter filling up the pupil, and although it may in young subjects become absorbed, yet in older subjects it is dangerous to delay extracting it. Therefore the best thing to do is give the patient chloroform, put the speculum into the eye and making a small incision in the middle of the old one, to either let the soft matter ooze out, or if it is more adherent, to try and get it out with the scoop or to use the suction apparatus, being, whichever method is employed, particularly careful to avoid touching the iris again. The great object is to remove

the soft matter, which, by its increase in volume, is pressing on the iris as quickly and as gently as possible. After the matter or most part of it has been removed, apply atropine and again fasten up the eye as before.

*3rd day.*—The same precautions as the 2nd day. Sometimes the soft matter does not make itself felt till this day.

*4th day.*—Between the 3rd and 5th days are the most frequent times for the supervention of iritis, and on these days it is most important if any pain is complained of to examine the eye. In all the foregoing days' examination the condition and appearance of the conjunctiva must be carefully examined. As a rule nothing very serious is about to happen if the conjunctiva looks at all inclined to be pale, and again it is always a good sign when it does not show any symptoms of infiltration and œdema.

The first four days may have passed over without any untoward symptoms, and on the morning of the fifth day, but very frequently I have found it rather sooner, about the third day, the patient will complain

of a dull pain in the forehead and temple of the side on which the operation has been performed. On removing the pad, it will be found to be wet, and on opening the eye tears will flow, and there will be a good deal of photophobia or dislike to light. We then know that iritis has set in and all our endeavours must be made to lessen its severity. If the pupil still appears black and clear, we have not much to fear; but if, on the other hand, we see a dirty yellowish appearance of the pupil, we must expect the case to be a troublesome one, one in which, however, with care we may be able to effect a great deal in preventing the vision being lost. The first indication is to try and ease off the iris which is now in a swollen and inflamed condition. This is best managed by leeching the temple with the artificial leech if at hand.

I always mention the artificial leech as being preferable to the natural leech, as the suction it causes is employed over a much greater margin, and as this suction must attract the blood away from the eye, it acts beneficially not only by drawing off blood, but by attracting blood to flow in a direction away from the eye. That it does this is easily seen from the fact

of the pain so often ceasing almost immediately the suction begins. I look upon it as a *sine quâ non* among instruments, and one which every man who operates should possess. It only costs about one pound at Weiss's and with care will last a lifetime.

The second indication is to keep the pupil thoroughly dilated, and this is best done by applying a belladonna pad—a pad soaked in belladonna lotion—besides instilling atropine in daily; there is no good in putting in atropine more than once a day, and the belladonna pad allows of absorption of the drug from the pad. The great thing is to keep out the light and to leave the eye as quiet as possible; so I may say it is imperative not to examine the eye more than once a day. A complication which often arises in a case of iritis following operation is the condition of the edges of the lids; these, from the constant flow of tears, become abraided. In this case it is much better to dispense with the pad and to simply smear the lids and brow with belladonna ointment and cover the eye up with a dark bandage which does not press on the lid at all. The food given must be of the plainest, milk and rice for choice, and the bowels should be

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attended to. Of drugs I prefer the Tincture of Iron or some other preparation of the same drug. If the patient is in good health, then I administer mercury in small doses, blue pill being the best form combined with opium.

Pain varies, sometimes being very severe. When this is the most urgent symptoms, half a grain of morphia will be found advisable, twice a day, given as a pill. When the inflammation is lessening it may be found that the pupil will have become completely blocked up, and this is always the outcome of a bad case. The treatment necessary in a case of the kind will be described further on.

In some cases when the pupil is plainly seen to be filled up with yellowish lymph, a very effectual plan is to let out the aqueous humour by tapping the anterior chamber; to do this, all that is necessary is to pass a Von Graefe knife in through the original wound and to turn it slightly round so as to widen the opening. Let the aqueous humour flow out, and some of the fluid lymph will follow; but do not attempt to put any other instrument into the eye; then close the eye up and the

benefit of the operation will show itself at once by the decrease of the pain and watering of the eye. This is only advisable when the inflammation is severe.

A complication very commonly seen a few days after the operation is the turning in of the lower lid, by which the hairs of the lid impinge upon the eye and set up a chronic inflammation. A case of this sort is known by the persisting redness of the eye although the iris, pupil, and cornea look quite healthy. It will then be seen that the lower lid hairs are actually lying on the conjunctiva. This can be remedied in several ways, either by applying a piece of sticking plaster in such a way as to draw down the lid, or by applying collodium as mentioned before, or by putting a stitch into the skin of the lower lid and fastening it down. This last is only necessary where you have a case in which there is also iritis, as in this case the constantly moist condition of the eye loosens the plaster and prevents the collodium from acting efficiently. The stitch does its work quite long enough before it comes out.

While the iritis is progressing, observation must daily be made as to the appearance of the lower edge of the cornea, and on the first appearance of a yellowish

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line, a fine knife must be passed in just where it is apparent. The line consists of pus which has fallen from the cut inflamed iris and is called hypopyon. The knife must be carefully passed parallel to the iris so as not to wound it, and should be turned a little half round so as to enlarge the opening, allowing the matter to escape. Many cases recover after a hypopyon has formed, so it must not be looked upon a hopeless case.

Various degrees of inflammation occur during the first five days after operation, but those mentioned are the only degrees requiring particular attention.

Later on, the wound may be seen to have little black projections usually visible at the corners of the wound. These are herniæ of the iris which has been caught in the wound and behind which aqueous humour has formed causing them to bulge out. Sometimes these are so large as to cause pain and to set up a state of chronic inflammation. They should be seized with the iris forceps and cut off level with the eyeball and a pad and bandage re-applied with slight firm pressure. If they return, a point of caustic may be applied, and they will be found gradually to shrink up and disappear, merely leaving a small mark behind.



A most serious complication, and one which may arise at any time during the first few days, is giving way of a vessel of the choroid. This causes the eye to fill with blood and causes a sudden acute pain.

The best thing to do if the patient complains of a sudden pain is to at once open the eye, and if the anterior chamber is seen filled with blood and the pad soaked with it, to apply ice to the eye. This case is a very hopeless one, but with prompt treatment an eye may be saved.

Now we will suppose all signs of inflammation have subsided, but there is still an appearance of a false membrane over the pupil which obscures the vision. Making certain that the eye has quite settled down after the operation, we must now endeavour to remove this obstruction to distinct vision.

There are various degrees of this complication. *1st*, where a membrane varying in opaqueness appears partially across the pupil, some parts being quite clear, the pupil being of same size as on the day of operation; *2nd*, where the membrane, although filling up the entire pupil, which is just the same size as it was the first day

of the operation, not having undergone any contraction, is semi-opaque and allows the patient to distinguish objects but not to read; *3rd*, when the same membrane exists, but is so thick as to obscure vision of objects and their definition altogether, the pupil being as in the last case just as large as before the operation; *4th*, where the membrane is semi-opaque but the pupil has become distinctly smaller having undergone contraction, the patient's vision allowing of the perception of large objects; *5th*, where the membrane is very opaque and the pupil contracted, the iris having the appearance of being on the stretch; *6th*, where the pupil has disappeared altogether and all that can be seen of it is a small narrow slit filled up with white lymph, vision being *nil*, the iris being more stretched than in the last case; *7th*, where the upper part of the cornea over the incision has become opaque and nothing can be seen of the pupil, the iris beneath the clear part of the cornea being evidently very tightly stretched.

We will now consider each degree of complication, with its most appropriate treatment.

*The 1st degree.*—In this degree the vision of the patient will be found to depend upon the amount of

pupil left clear, and any interference must depend entirely on the vision and its usefulness. If the patient is a person who earns his living by writing, or a person of education who is very anxious to be able to read again, and in whom the presence of the membrane is the evident cause of his not being able to do so, then a secondary operation is advisable. If, however, the patient is a beggar or one who merely has to find his way about, and in whom acute vision is not actually necessary, then nothing more should be done, as it is hardly necessary to say all interference has dangers attending it, and particularly so in this case, where the iris is so closely involved, and nothing is so disheartening as finding inflammation result after an operation which was not actually a necessity.

The best plan to adopt then in the first degree is to try to tear down the membrane with two needles, one passed in at either side of the cornea and then made to transfix the membrane; by then bringing the handles together the membrane is torn across without any tension on the iris, to the back of which the membrane is attached more or less. If the membrane, however, gives the idea of being quite free from attachment, then

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the most effectual way is to make a small incision in the line of the original one and to carefully insert the iris forceps and to seize it and withdraw it. This done successfully without injuring the iris always gives the happiest result. In all these cases of secondary operation, it is always advisable to chloroform the patient, if possible, as the delicacy of the operation requires that the eye should be perfectly under control.

*The 2nd degree.*—The one and only operation advisable is the tearing the membrane through with the double needle, as filling up as it does the entire pupil it must have attachment inside, and any attempt to remove it will most certainly lead to further trouble.

*The 3rd degree.*—Here we come to a much thicker membrane and one which evidently consists of more than mere capsule, which all the last two degrees have consisted of. In this degree we have to contend with capsule *plus* exuded lymph, which has been thrown out in sufficient quantity to render the capsule opaque, having flowed all over its surface, but not in sufficient quantity to contract and render the pupil any smaller. To remedy this we must have recourse to a more complicated operation. We know that this opaque material

has formed attachment of the iris, and we know that we cannot trust to its curling up if simply torn with needles, so we have to make up our minds to divide it in some other way. The most satisfactory way there is to use the instrument known as Dr. Wecker's Iridotomy scissors or Noyes,' both being equally good. A very small incision is to be made at the most favourable part of the sclero-corneal junction, and the scissors introduced closed; one blade, the sharp one, must then be passed behind the membrane, and the other in front, and then the cut made, the wound will then gape and allow of light penetrating to the retina. It will frequently be found that one operation will not be sufficient, and the same proceeding must be repeated a few days afterwards, when, with skill, the pupillary opening may be fashioned quite a respectable shape.

*The 4th degree.*—We have a condition in which the lymph thrown out has contracted the pupil, but has become more or less absorbed not causing contraction of the pupil; here the best operation again will be the scissors one as just described. But still, if there is a good sized pupil left, the double needle may

be tried, and will, in many cases, be found effectual. It all depends on the amount of elasticity left in the capsule; if this is *nil*, then the wound made by the needles will not gape and the scissors will have to be used.

*The 5th degree.*—We have a case in which the contraction of the effused lymph has gone on to a greater degree than in the preceding case, and as the pupil is contracted and the iris appears stretched, we have a case in which another operation can be introduced which takes advantage of this stretching.

When the iris is put on the stretch, the radiating fibres are naturally pulling against the contraction, and it is by taking advantage of the knowledge of this fact that this operation was introduced. It consists of passing a Van Graefe knife in at the margin of the cornea and passing it almost across to the opposite side of the anterior chamber. The point must then be passed through the stretched iris and with the cutting edge towards the iris, a clean cut be made across the radiating fibres. The immediate result is a gaping of these fibres, and if no blood is thrown out a very good

slit-shaped pupil results. It will be found, however, in this degree that the scissors operation will generally succeed, as the moment the iris finds itself detached from the opaque membrane, when this is cut across it retreats and leaves the pupil clear; either then of these operations will meet the degree and give back good vision.

*The 6th degree.*—The best operation and only one which promises success is the one just described with Van Graefe's knife. Here I will mention that as a rule the greater the contraction of the pupil and consequent stretching of the iris, the greater extent of lymph has been thrown out, and this effused hardened contracting lymph will therefore be found extending further and further behind the iris, the greater the appearance of stretching of the iris. Now, the practical value of this point is that the greater the stretching appears to be the further away from the lower margin of the pupil should the incision be made, or the effused lymph will be found to show through the incision, and as it is not elastic in any way, it will prevent the iris retreating and interfere with the result most materially. Therefore, the incision should be made well at the lower margin of the iris.

*The 7th degree.*—The same operation may be found effectual if the suffused lymph does not extend far behind the iris. If it does, then a combination of it and the scissors operation will be necessary, that is to say, the knife should first be tried and if the wound does not gape, then the scissors should be passed in and the wound cut to shape, if possible, an oval piece being cut out of the iris.

Now, with regard to the best means of giving the most acute vision to a patient whose eye has been successfully operated on, it will be found that scarcely a single case is free from astigmatism to a more or less degree, and this is important. In some cases the bent condition of the front of the cornea is quite evident to the naked eye, and to give an example of what a great difference it makes to the patient, I will quote two cases, 1st, A B operated on in February 1885, got 10D spherical glasses, could see objects, and went away apparently perfectly well; he could not be made to see letters; he returned as ordered in September 1885 and was again examined. I found his astigmatism amounted to + 6D, and the glass with which he can now read is a plain + 7D with Cyl + 6D, axis perpendicular;

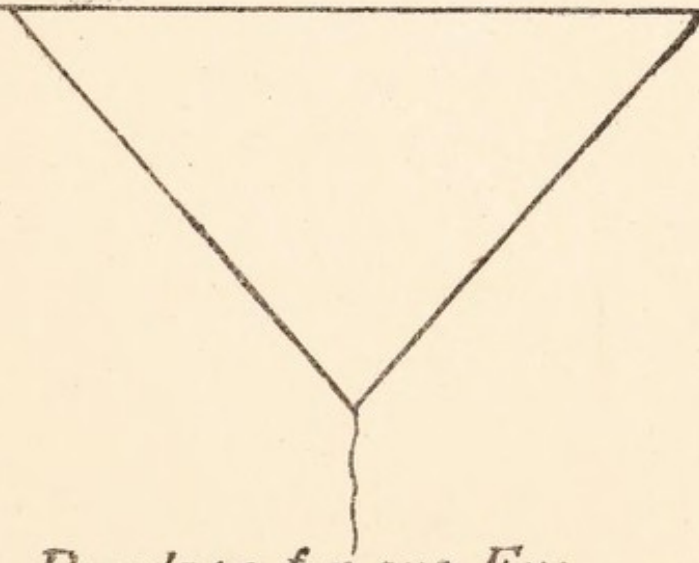


2nd, B C operated in March could not be made to read with plain glass ; has now been tried and can read with plain + 6D. Cyl + 6D, angle about  $20^{\circ}$ . These cases show that in every case of any difficulty of reading or seeing close objects, astigmatism must be looked for and a glass found to take the place of the bent cornea. In judging the astigmatism, straight lines, perpendicular and horizontal, are most useful. The astigmatic clock answers the purpose very well.

My work is now finished. Although I am aware that it is far from perfect, yet I hope that it may prove useful to some who are, as I once was, gaining their experience in *paupere vili*.



*Bandage applied.*



*Bandage for one Eye.*















