

## CHAPTER XIII.

## DISEASES OF THE LENS.

*Pathology of cataract—Lenticular cataracts—Soft—Cortical—Hard—Treatment—Preparation of patient—Operation—Depression—Solution—Flap extraction—Modifications—Linear extraction—Traction operation—Modified linear extraction—Linear extraction without iridectomy—Choice of an operation—Capsular cataract—Traumatic cataract—Dislocations of the lens.*

## PATHOLOGY OF CATARACT.

**CATARACT.** CATARACT.—The subject which will almost exclusively engage our attention in this chapter is that of opacity of the lens, or cataract.

The term cataract should be restricted to instances of opacity of the lens in which, so far as we can ascertain, no disease exists in any of the other structures of the eye. The tension of the eyeball is normal; the patient does not experience sensations of flashes of light before his eyes; the iris is healthy, and responds, though it may be slowly, to the stimulus of light. In fact, the symptoms of cataract are gradually increasing dimness of vision, which is accounted for by advancing opacity of the lens. If the opacity is in the capsule, and the lens is transparent, the term capsular cataract is employed. If both lens and capsule are opaque, we call the condition a capsulo-lenticular cataract.

*Causes.*—The causes of cataract, excluding traumatic and capsular cataracts, have long been a subject of dispute. It is possible that, in some instances, alterations in the constituents of the blood have a direct influence on the formation of cataracts, as, for example, in diabetes; nevertheless it is a mistake to fancy that persons suffering from diabetes are very subject to cataract;

and it is a still greater mistake to suppose, such persons do not make good recoveries after operation. Dr. F. Kunde,\* increasing the specific gravity of the blood by injecting saline solutions into the intestines of living frogs, found that their lenses became opaque, and the opacity disappeared as soon as the consistency of the circulating fluid was restored. He also discovered that by freezing these animals their lenses were rendered opaque, and arrives at the conclusion that molecular changes taking place in the tubes (of which he conceives with Kölliker that the lens is composed) render the crystalline opaque. So far as the tubes of the lens are concerned, I cannot agree with M. Kunde, but when we consider that the lens contains upwards of 60 per cent. of water in its normal state, we may readily concede this much, that alterations in the specific gravity of the blood may very well occasion such molecular changes in the lens as shall render it temporarily opaque. But admitting all this, it hardly brings us nearer the solution of the question as to the actual cause of cataract, more especially as we find, in certain diseases attended with a great drain of water from the blood, as cholera, that opacity of the lens does not occur.

Cataract appears in very many cases to be due to fatty degeneration of the lens fibres, and this condition may be induced by causes affecting its nutrition, whether arising from alterations in the blood, from defective innervation, or from mechanical separation.

Traumatic cataract may be induced, as in the experiments of Dr. A. Moers,† by passing a fine thread through the lens. In the first instance, changes occur in the cells lining the capsule, these give rise to rapidly increasing cell-growths, and as this process advances, alterations take place in the nucleus of the lens, which becomes opaque, and lastly, its cortical substance is involved in the degeneration.

*Classification of Cataracts.*—Cataracts may be divided into two classes, the lenticular and capsular; in the former the lens is involved, and in the latter the

Artificial production of.

From temporary molecular changes in the lens.

No parallel in pathology.

Spontaneous cataract, fatty.

Traumatic cataract.

Experiments of Moers.

Classification of cataracts.

\* "Zeitschrift für wiss. Zoologie," von Siebold u. Kölliker, Bd. viii. p. 446, 1857.

† "Arch. für Path. Anat.," von R. Virchow, Bd. xxxii. p. 45, 1864.

capsule; or rather, the inner or outer surface of the capsule becomes opaque, in consequence of the formation of neo-plastic growths in this situation. Lastly, we shall have to consider the circumstances of traumatic cataract.

LENTICULAR CATARACT.

LENTICULAR CATARACTS may be described under four heads: the soft, cortical or mixed, senile or hard, and zonular cataracts.

1. Soft cataract. In the young.

1. *Soft Cataract* is most commonly met with among infants and young people, the patients being under thirty years of age.

Contents of capsule fluid.

In instances of soft cataract the fibres of the lens not only undergo fatty degeneration, but are disintegrated and broken up. On account of the contents of the capsule being fluid, it bulges forwards, pushing the iris before it, and lessening the antero-posterior diameter of the anterior chamber.

Looks like cream.

It is hardly possible to mistake this form of cataract; the pupil being fully dilated with atropine, the opaque lens appears like a bag full of creamy fluid, being perfectly free from striae, whether examined by direct or transmitted light. A few opaque or chalky-looking spots are occasionally noticed on the inner surface of the capsule, and now and then flakes of cholesteroline may be seen in it. On examining the lens with the ophthalmoscope, it will be found that the opacity reaches to the circumference of the lens, so that we cannot possibly see any portion of the fundus of the eye in these cases.

Opacity extends to margin.

May be absorbed,

It sometimes happens that the contents of the capsule when fluid are gradually absorbed, with the exception of a small quantity of its earthy material, which attaches itself to the inner surface; at the same time the capsule shrinks, so that ultimately we notice a white, irregular-looking membrane, situated behind the pupil, and by transmitted light its surface appears wrinkled. The opacity seems to be placed at some little distance behind the iris, a space evidently existing between the pupil and the opaque membrane.

leaving an opaque membrane.

Often very tough.

The remains of a soft cataract of this kind are generally very tough, and the elasticity of the capsule having been greatly impaired, or lost, it is difficult to destroy these membranes with a needle; they are

better taken away by opening the anterior chamber, and seizing the opaque capsule with a pair of forceps, when it may be withdrawn from the eye.

2. *Cortical, or Mixed Cataract*.—Until the age of forty the nucleus of the lens is hardly distinguishable from its cortical substance, and as the so-called cortical cataract often occurs before this age, the term is scarcely well chosen to distinguish this form of the disease from opacities involving the nucleus of the lens.

2. Cortical cataract in middle age.

Name ill-chosen.

The first appearance of a cortical cataract is generally observed as a series of striae, commencing at the circumference of the lens and converging towards its centre. The striae are often situated at some distance behind the iris, in the posterior layers or substance of the lens; the pupil having been dilated with atropine this condition is best seen by the direct method of examination; or by lateral illumination. As the cataract advances, the striae increase in breadth and length, and become of a whitish colour; the younger the patient, and the more rapid the advance of the cataract, the broader and more mother-of-pearl like the opaque bands in the lens appear. They ultimately occupy the entire lens, when the cortical cataract is complete.

Striae begin at circumference.

The fully formed cataract presents the following appearances: undilated, the pupil lies immediately on the opaque lens, the degenerated cortical substance extending up to the anterior capsule.\* The pupil having been dilated with atropine, the lens appears uniformly opaque, and is marked with bands of mother-of-pearl or opal-like appearance; the centre of the lens may present a slightly yellowish tint, and by transmitted light it will be seen to be of a denser consistency than its circumference. This point is best determined, however, by the ophthalmoscope; with the aid of this instrument we shall discover that the margin of the lens allows a certain number of the rays of light to pass through it, and a reddish reflection may be observed from the fundus of the eye; the denser central portion of the lens entirely obstructs the rays of light from reaching the choroid, and appears as an opaque mass, surrounded by a dim reflection

When fully formed, the iris lies on the cataract.

Opal-like bands.

Margin of lens less dense.

Allows a reflection from the retina.

\* "Maladies des Yeux," M. Wecker, vol. ii. p. 150.

from the fundus through the circumference of the lens. In the case of a soft cataract no such coloration is observed, nor are there any striæ to be seen on its surface. If the cortical cataract appears in a person advanced in life, or is of long standing, the fibrous bands of the cortical substance are less marked, and the centre of the lens (its nucleus) assumes a more decidedly amber tint.

3. Senile cataract.

Lens opaque with age.

Rare before forty-five.

Characteristic amber nucleus.

Opalescent striæ.

Cortex semi-transparent.

3. *Senile, or Hard Cataract.*—One of the difficulties we meet with in tracing the characteristic appearances of a senile cataract, arises from the slow invasion and indefinite character of the disease in its early stages. As a person advances in life, senile changes take place in the lens by which its nucleus is rendered amber-coloured and in some degree opaque, and yet the individual may possess very good sight, at most being only presbyopic, and is not considered to have cataract; but if this degeneration advances, and the nucleus of the lens becomes sufficiently opaque to prevent the rays of light from reaching the retina, a senile cataract is then said to exist.

This form of cataract seldom occurs in a patient under forty-five years of age. In its early stages the lens presents a yellowish, or amber colour, most marked in its centre, and a clear space may be seen to exist between the pupil and the opacity, the cortical substance of the lens being comparatively unaffected. On dilating the pupil, we shall notice opalescent striæ extending from the circumference towards the axis of the lens. As the disease advances the striæ become deeper and more distinct, but still the prominent feature in the lens is its amber-coloured centre, which is indeed the principal characteristic of the hard cataract. On examination with the ophthalmoscope, the circumference of the lens will be found to be less opaque than its nucleus, and a reflection from the fundus of the eye will be observed. It is in consequence of the nucleus of the lens being most early involved in cases of this kind, that patients see better after sunset, or when the pupil is slightly dilated, so that rays of light can pass through the margin of the lens to the retina. A weak solution of atropine, if applied to the eye once or twice a week, by keeping the pupil slightly dilated, may enable such a person to walk about, or even read and write with comfort.

In these cases of senile cataract, we may frequently observe delicate spots on the inner surface of the capsule; they consist of fatty epithelium; and as these degenerative changes advance in the cells of the capsule, it becomes firmly glued down to the cortical substance of the lens, so that it is often difficult to separate the two. At the same time the lens becomes flattened from before backwards, and its circumference sharp and contracted; this, in fact, is the usual form of the lens after it has undergone senile degeneration, and become converted into a hard cataract.

Capsule spotted and adherent.

Lens flattened.

The length of time which a senile cataract takes to form is very uncertain. We are frequently pressed by patients to state how long they are likely to be able to read, or get about by the aid of the affected eye; but we must carefully avoid committing ourselves to an opinion on these matters, for it is quite impossible to determine, in any individual case, how long these senile changes may continue without producing blindness.

May take a long time to form.

4. *Zonular Cataract* is most frequently a congenital affection, but may occur in after life as an effect of irido-choroiditis.

4. Zonular cataract. Often congenital.

In infancy, opacities of the lens of this description may be overlooked, the child not showing any signs of defective vision until he is about two years old and begins to employ his eyes on small objects; even then he may see very well. I have now a young man under my care, nineteen years of age, who is affected with zonular cataract in both eyes, but is employed as a compositor, and states that his sight has not grown worse as long as he can remember; but from constantly holding his head close down to the type upon which he is engaged, so as to magnify the visual image, he has become intensely myopic; it was on this account that he lately consulted me.

Compatible with useful vision.

The opacity of the lens in zonular cataract is situated between the posterior cortical layers of the lens and the nucleus; it is seen, therefore, at some distance behind the pupil, the anterior cortical substance and the nucleus intervening between the opacity and the iris.\*

Situated in posterior layers of the lens.

The pupil having been dilated with atropine, a

\* "Augenheilkunde," Stellwag von Carion, p. 621.

whitish grey film is seen in the lens in the position above indicated, looking very much as though a piece of silver-paper had been stuck on to the posterior surface of the lens. The opacity is always greatest in the axis of vision, often appearing to be of a chalky consistency, with stria radiating outwards from this central portion; the circumference of the lens is frequently perfectly transparent.

Opacity  
greatest in  
the axis.

Stationary  
form.

Progressive.

These cases of zonular opacity may be divided into two classes, the stationary and the progressive. In the former, the opacity is always well defined, small, and the circumference of the lens perfectly transparent. If a zonular cataract presents appearances of this kind, we may be almost certain that it will not advance for years, or it may be for life. On the other hand, if in addition to the central opacity, we notice that the circumference of the lens is marked with small opaque dots, or striae, we may be sure that the cataract will progress, and we must plan our procedure accordingly. These streaks and spots in the cortical substance of the lens are best seen by means of the lateral method of illumination.

Fundus  
visible with  
ophthal-  
moscope.

If an eye affected with zonular cataract be examined with the ophthalmoscope, we shall, unless in a far advanced case, see the fundus of the eye clearly through the circumference of the lens; and even through its densest portion a dim reflection from the back of the eye will be perceptible.

Diagnosis  
important.

It is a matter of considerable practical importance to diagnose between a stationary and advancing zonular cataract, for in the former the operation of iridectomy will be necessary, but if the cataract is advancing it is better to remove the lens.

Black  
cataract.

Several other rare forms of cataract have been described by various writers on the subject; among these *black cataract* has held a prominent place; this form of opacity of the lens appears to arise from an infiltration of hæmatine into the opaque lens,\* and often indicates some deep-seated disease of the eye; choroïdo-retinitis has more than once been observed after extracting such a lens.

The *calcareous* or *bony cataract* is another rare form

\* "Maladies des Yeux:" L. A. Desmarres, t. iii. p. 72.

of disease, the lens undergoing calcareous degeneration similar to that met with in other parts of the body. Bony  
cataract.

#### TREATMENT OF CATARACT.

**PRELIMINARY EXAMINATION.**—Before describing the operations usually resorted to for the removal of an opaque lens, it will be desirable to point out certain preliminary considerations which should precede any operative interference, and the result of which must guide us in the choice of an operation, and the general management of the case. We should endeavour to ascertain, in the first instance, the special characters of the cataract to be operated on—first, as to its consistency, and secondly, as to the extent, of the cortical portion involved: and lastly, we should investigate the condition of the eye irrespectively of the cataract, the state of the patient's health, together with the preparatory treatment which may be necessary before the operation. TREAT-  
MENT OF  
CATARACT.  
  
Preliminary  
inquiry.

1. *As to the Nature of the Cataract.*—There can be no difficulty in the diagnosis of a zonular cataract; but the question often arises whether the cataract is a fluid or a cortical one, and doubtless in some cases the two forms of cataract run into one another, and the character may then be obscure. But the pupil having been dilated with atropine, if the anterior surface of the lens appears to bulge forwards, the lens being uniformly opaque, and of a cream colour, no striae, or only faint ones, being visible on its surface when examined by transmitted light, when, moreover, with the ophthalmoscope, we find the lens densely opaque up to its circumference,—under these circumstances, we may almost safely predict that the contents of the capsule are fluid. 1. Nature  
of the  
cataract.  
  
Zonular  
unmistake-  
able.  
  
Diagnosis  
of soft.

In some rare instances the nucleus may be hard and the cortex fluid (a Morgagnian cataract), in which case the hard nucleus can be seen floating about in the fluid lenticular matter. Cases of this kind are not likely to occur before the patient is forty years of age, for until that time of life the nucleus of the lens can hardly be said to exist. Morgagnian  
cataract.

The cortical cataract, when fully formed, presents the mother-of-pearl-like striae, or bands, on its surface, which are characteristic of this form of opacity of the Cortical  
known by  
its striae.

lens; but the opaline, fatty cortical substance may often enclose a hard nucleus, especially if the patient is upwards of forty-five years of age. We must always carefully examine an eye affected with apparently cortical cataract by transmitted light, and if we detect an amber tinge in its central part, we may fairly expect that its nucleus is a hard one.

Nucleus  
may be hard.

Senile  
amber-  
coloured.

2. Ascertain  
extent.

Transparent  
fragments  
dangerous.

Is a space  
seen between  
iris and  
cataract?

Proposal to  
hasten for-  
mation.

Lastly, the amber colour of the senile cataract is hardly to be mistaken, especially if striæ are seen radiating inwards from its circumference, and if on examination with the ophthalmoscope we find the centre of the lens densely opaque, while its outer part allows a few rays of light to pass through it from the fundus.

2. *Extent of the Cataract.*—Having formed our opinion as to the nature of the cataract, the next question is as to the extent to which the lens is involved;—is the whole of its cortical substance opaque or not? It is of considerable importance to determine this point, because, if the cortical substance of the lens is still transparent, during the extraction of the cataract the cortical matter may become detached and entangled in the iris, and, escaping our notice, it may subsequently set up inflammation in the part, and cause dangerous hyperaction in the deeper structures of the eye. If, on the other hand, the whole of the cortical substance is opaque, we shall more easily see any fragments of the lens which may happen to be left in the anterior chamber, and may generally remove them without difficulty with the scoop.

The best means we have of ascertaining the extent of the cortical substance implicated is, to examine the eye by transmitted light, noticing if the free margin of the iris appears in absolute contact with the opaque lens, or if there is a space between the pupil and the cataract; in the former case the anterior part of the cortical substance is evidently opaque; but if the iris appears separated from the cataract, some of the cortical substance of the lens is still transparent. We shall more readily observe these distinguishing features if the pupil has been very slightly dilated with atropine.

It has been proposed, in cases where the cataract has been long forming, and therefore causing considerable impairment of vision, but yet the cortex of the lens has not become wholly involved, to puncture the capsule, and thus hasten the degenerative process. In-

stances may sometimes occur where this plan is advisable, but I should generally prefer, having performed iridectomy, to extract such a lens in its capsule, so that none of the soft and transparent cortical matter might attach itself to the iris.

Another important question is likely to arise regarding the maturity of a cataract. Supposing that in one eye the lens is opaque, and in the other tolerably transparent, should we wait till both eyes are equally involved before operating, or should we remove the cataract at once? It seems better, without doubt, to get rid of the opaque lens under these circumstances, because there can be no valid reason for keeping our patient in suspense and discomfort till he is completely blind, when by operating on the one eye he may be able to use it, while the degeneration is progressing in the other, and may thus be enabled to perform the ordinary duties of life without interruption.

It may be laid down as a general rule, that, when both eyes are involved, only one should be operated on at a time; I hardly know of any circumstances that would make me perform a double extraction at one sitting, unless in the instance of double traumatic cataract, when we should do well to relieve both eyes as soon as possible from the irritation induced by the swollen and opaque lenses.

3. *As to the Absence of Complications.*—Before undertaking an operation for the cure of cataract, we must be fully satisfied that the case is one of pure cataract. This observation may appear superfluous; nevertheless the caution is very necessary, because opacity of the lens and cataract may be very different things. It is not necessary for me to recapitulate the characteristic symptoms of glaucoma, choroiditis, irido-choroiditis, and such like diseases, which implicate the lens and render it more or less opaque, because I have distinctly defined cataract to be an opacity of the lens arising from no such assignable causes. If, therefore, the iris is unhealthy or the tension of the globe is abnormal, the case is not one of simple cataract; and unless we are thoroughly acquainted with the various diseases which cause opacity of the lens, we cannot possibly undertake so serious an operation as extraction with any confidence of success.

It is always desirable to determine, before operating

If one lens  
only is  
opaque, re-  
move it.

Operate on  
one eye only  
at a time.

3. Ascertain  
the absence  
of other  
disease.

Test the amount of vision,

by dilating the pupil,

and using a light in a dark room.

4. Inquire as to general health.

If good, no preparation.

Ascertain temper,

for cataract, the amount of vision the patient possesses, for it may happen that in addition to the cataract he has atrophy of the disc, or detachment of the retina, or other disorganization—conditions which we could not ascertain by any external symptoms, and which may have come on so gradually, that the patient himself may be quite unaware of there being any complication of the kind. To determine the amount of vision, the pupil must be fully dilated with atropine; and I may here remark that *if the patient's pupil does not dilate readily on the application of atropine to the eye, it is an unfavourable sign*, the choroid, or iris, being very probably compromised. The action of the mydriatic being fully established, the patient is to be taken into a dark room, and the flame of a lamp held at various distances, and in different positions with respect to the eye; if he sees the flame with tolerable distinctness in all directions, particularly above and below the eye, we may be pretty certain that no detachment of the retina exists, and that the optic nerve is healthy. Even in the case of young children we may generally succeed in making an examination of this kind, and it is very necessary, for the soft cataract met with among infants, especially if accompanied with a rolling motion of the eyeballs, generally indicates deep-seated disease. Our prognosis in such a case will be far from a happy one, unless the little patient's attention is caught by, and his eyes follow, the flame of a candle held before him.

4. *General Health.*—We must also take the circumstances of the patient's general health into our consideration before operating for cataract; if weak, or otherwise out of sorts, we must put off the operation until his health improves. The existence of chronic bronchitis is especially against the success of the operation. All that can be said on this subject is, do not operate if the patient is not in his usual state of health, and if he is, the less preparatory treatment he has the better, unless we propose giving ether, as I shall subsequently explain.

Besides carefully considering the state of the patient's health, we must also satisfy ourselves as to his temper. I lately had under my care an unfortunate gentleman, whose history has left a lasting impression on my mind: his general health was good, and the

eye most favourable for operation, but, unfortunately, my patient possessed a most irritable temper; no sooner was the operation over than the bandages were torn off, all rules and treatment set at defiance, and of course the eye was lost. It is seldom that we meet with patients of this kind; and our best chance of obtaining information on the subject is through their usual medical attendant or friends, it is evidently necessary to make inquiries on these matters. It is also well to allow our patients to settle any business they may have in hand, so as to be able to give themselves up entirely to our bidding during, and after, the operation.

PREPARATION OF THE PATIENT.—As I have above stated, the immediate preparation on the part of the patient will depend upon whether we are going to administer ether while operating or not; if not, the less we interfere with his usual habits, the better.

*Ether.*—If we propose giving ether or chloroform, it is well to prescribe a dose of castor oil, or some other purgative, two days before the operation, and the day immediately preceding it the patient should take no solid food after 1 P.M.; we should then endeavour to operate early the next morning, before he has tasted either liquid or solid food. If these precautions are followed out it is very seldom indeed that a patient will vomit after inhaling ether.

With regard to the advisability of administering ether during the various operations for extracting the lens. The principal arguments against its use are, that people have died under its influence, and that it is likely to be followed by vomiting. The first of the objections, if valid, is equally applicable to other operations, and is hardly tenable at the present day; and as to vomiting after ether, if the patient is previously prepared, it seldom occurs, and should vomiting take place, an elastic bandage secured over the eye immediately after the operation, prevents injurious consequences. I may add that a subcutaneous injection of morphia prior to the operation, will almost certainly prevent vomiting, if used in addition to the preparatory measures above described.

On the other hand it may be urged, that during extraction it is most important to have the patient absolutely passive and free from pain, and this anæ-

and make what provision we can.

PREPARATION,

in case of ether.

To prevent vomiting.

Objections to ether.

Advantages greatly preponderate.

thetics secure, rendering the proceeding comparatively easy, and increasing the chance of success, particularly if the operator is young at his work; and lastly, it saves the patient some suffering and anxiety.

Anæsthesia should be complete.

Upon one point I would strongly insist, it is this—that the patient should be rendered absolutely and completely insensible; both sensation and reflex action must be totally in abeyance during the time we are operating, otherwise it were far better to leave anæsthetics alone. Unless I have an assistant with me who is in the habit of administering ether, I very much prefer giving it myself, and then proceeding to operate; there is nothing so fidgeting as seeing an assistant turning to you with a diffident air, as though to inquire if you wished any more ether given, or as if seeking to know whether all were safe with the patient; under these circumstances it is better to take the matter in hand oneself.

Disapproved by some.

Before closing these remarks on anæsthetics, I am bound to observe, that some of our most able surgeons seem hardly to approve of them. It may be that these gentlemen have had such vast experience, that they do not stand in need of the aid which ether certainly affords the operator, and doubtless after long practice one feels that in many cases better success may be obtained in removing a cataract without the aid of anæsthetics; nevertheless to surgeons who have not the wards of an ophthalmic hospital at their command, I can say with confidence, operate when your patient is fully under the influence of chloroform, and then, with ordinary care and knowledge, your success will be great; abstain from giving chloroform, and you may spoil many eyes before you can attain the like happy results.

Invaluable to less skilful operators.

I may now proceed to describe the operations employed for the cure of cataract, and I shall subsequently make a few general remarks upon the applicability of the various operations to different cases.

#### OPERATIONS.

(See selection of an operation, p. 504.)

RECLINATION OR SCLERONIXIS.

DEPRESSION OR RECLINATION OF THE LENS.—The instrument required for the operation is a fine needle having its free extremity flattened and slightly curved.

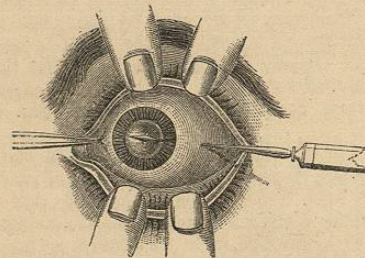
The pupil having been dilated with atropine, the patient is to be seated on a low chair facing a window, so that the light may fall upon the eye to be operated on. The other eye being covered, and the eyelids of the eye to be operated on being kept open by means of a spring speculum, the patient's head is to be secured by an assistant, and the surgeon either standing or sitting in front of his patient proceeds to perform the operation.

General arrangements.

Supposing the left eye is to be operated on, the surgeon, taking the curved needle in his right hand, as he would a writing pen, should rest his fourth finger on the patient's temple, and run the point of the instrument through the sclerotic, at about a line from the

Operation described.

FIG. 35.



circumference of the cornea, a little below the level of the horizontal diameter of the pupil; then thrusting the needle onwards, its convexity being turned towards the iris, the concavity is to be pushed against the summit of the crystalline, so as to force the lens downwards; the needle is then to be passed round the lens, breaking through the suspensory ligament; and lastly, its curved point is to be drawn across the anterior surface of the lens, so as freely to rupture its capsule, after which the lens is to be thrust backwards into the vitreous (Fig. 35), leaving the pupil clear and vision distinct. The needle may then be withdrawn from the eye, taking care to keep its sharp point turned away from the iris.

Ligament and capsule torn.

Lens depressed.

The only after-treatment necessary will be to close

the eye for a few days with a pad and bandage. If any inflammatory or other complications occur, they must be treated upon the principles which I shall describe more fully when speaking of extraction of the lens by the flap operation.

**OPERATION OF SOLUTION.**

**Directions.**

Central perforation of capsule and cortex.

"Drilling."

Avoid doing too much at once.

The operation must be repeated.

Absorption tedious.

**THE OPERATION OF SOLUTION OR ABSORPTION.**—The pupil having been fully dilated with atropine, and the patient laid on his back on a convenient couch, in front of a good light, the eyelids are to be separated with a stop-speculum, and the surgeon, standing or sitting behind his patient's head, passes a needle rather obliquely through the cornea at a point just within the position of the fully dilated pupil, puncturing the centre of the anterior capsule and cortical substance of the lens. No pressure should be exercised on the lens, or we may thrust it backwards into the vitreous chamber; this may be avoided by using the needle as a drill, rotating its handle gently, so as to bore a hole through the capsule and into the lens. As the needle is being withdrawn from the lens, the capsule may be torn open to about the extent of the undilated pupil.

The size of the opening thus made in the capsule must, however, depend upon the nature of its contents: if fluid, we may freely incise the capsule, and allow the soft lenticular matter to escape into the anterior chamber; but as a general rule, we cannot be too cautious in lacerating the capsule; it is far better to have to repeat the operation than to do too much at one time.

In the majority of cases, the needle will have to be used as above described several times, at intervals varying from a month to six weeks; but it may be laid down as a rule, that so long as the eye remains at all irritable after one operation, a second operation should not be attempted: among persons advanced in life, it frequently takes a year before the whole of the lens is absorbed. At each fresh operation the needle may be more deeply drilled into the lens; but as I have before remarked, we can hardly exercise too much caution in these cases; for if any of the lens substance escapes through the opening we have made in the capsule, and attaches itself to the iris, it may set up violent inflammation, rendering it necessary for us to take away the

crystalline at once, or it is just possible we may succeed in introducing a small scoop through a wound in the cornea, and removing the offending particle from the eye.

I do not think it advisable in such cases to attempt a palliative plan of treatment for more than a few days; if our efforts to stop the inflammatory action, by the removal of the source of irritation with a small scoop, and subsequently by the frequent instillation of atropine, prove unavailing, we should proceed at once to remove the lens.

Provided no complications occur, the after-treatment of an ordinary needle operation is simple enough. As a matter of precaution, the eyes had better be closed for a few days, and the patient placed in a dark room; the pupil of the eye operated on should always be kept fully dilated with atropine, and if no irritation occurs, the patient may be allowed to go about as usual in four or five days after the operation, keeping the eye closed, however, and the pupil dilated with atropine for a fortnight after the operation.

**THE SUCTION OPERATION.**—This proceeding may be employed as an adjunct to the needle operation; that is, the capsule must first be freely opened, and the aqueous allowed to gain access to the lens, which rapidly undergoes degenerative changes, and after an interval of a few days may be removed with a Teale's suction instrument,\* or with a Bowman's syringe.

The instrument is to be used as follows:—The pupil being well dilated, a puncture is to be made in the cornea with a broad needle, opposite the fully dilated pupil, the needle should be thrust obliquely through the cornea, and the opening must be sufficiently large to admit the entrance of the nozzle of the suction instrument; the capsule having been freely divided, the curette must be gently buried in the opaque matter of the lens, our object being to break up the lens as far as possible without in any way displacing or irritating any of the surrounding structures. The nozzle of the suction syringe is then to be passed into the soft lenticular matter, and the piston being gently raised, the lens substance is sucked into the syringe

\* *Ophthalmic Hospital Reports*, vol. iv. p. 197.