

eyelids, at other times they are no larger than a pin's head. The thickness of their walls is also subject to variation: in many instances the summit of the staphyloma is very thin,

FIG. 23.



Perforation
or rupture.

whereas in other cases it is comparatively thick, and may contain a considerable quantity of cholesterine imbedded in it.

The apex of the staphyloma, as I have before remarked, may ulcerate, and a fistula form, through which the aqueous drains away: or the staphyloma may burst open, and through the rent thus made, the lens, and, in fact, the contents of the globe, escape; the eyeball then shrinks up, and sinks into the orbital socket.

Composite
forms.

It sometimes happens that more than one staphyloma exists in the same cornea. This condition arises from the previous formation of several ulcers in the cornea, which has accordingly yielded at more than one spot to the intra-ocular pressure, while the intermediate parts, retaining their fibrous structure, have effectually resisted the distending force, forming bands between which the several small staphylomata have occurred.

Effect on
vision.

The symptoms to which a staphyloma of the cornea gives rise consist principally in various degrees of impairment of vision, and will depend very much upon its position and size. When endeavouring to estimate what may be the ultimate effect of a staphyloma on the patient's vision, the condition of the iris is one of the first points for consideration, in instances where a portion only of the cornea is involved. Should the iris have been drawn into the protrusion, it is very probable that the pupil may likewise be included in the staphyloma, and of course the patient will not be likely to see much with an eye so affected. In other cases a part of the pupil may remain free, and should there be any transparent cornea in front of it, the patient may still retain a fair amount of sight. Again, supposing the staphyloma leaves the centre of the cornea clear, it is far less likely to impair the sight than if situated in the axis of vision. It is by no means an uncommon circumstance, however, for glaucomatous

If pupil
included,
little sight
will remain.

changes to occur in an eye in which a staphyloma has become developed; the degree of tension of the eyeball must therefore be carefully attended to in cases of this kind.

Treatment.—This will depend on the size of the staphyloma and the length of time it has existed.

1. If the protrusion be a small one, and of recent formation, the best thing we can do is to puncture the inferior part of the staphyloma with a broad needle, so as to allow the aqueous to escape, and then apply a firm compress and bandage over the eye; the instillation of atropine should also be employed. Our first object in this proceeding will be to empty the anterior chamber of aqueous, which is probably forcing the staphyloma outwards; the intra-ocular pressure being thus removed, the compress not only prevents a reformation of the staphyloma, but also stimulates the part to increased action, hastening the formation of cicatricial tissue, which effectually retains the parts in their normal position. The atropine is employed with the view of retracting the iris, so as, if possible, to disengage it from the cornea.

Treatment.
1. If small
let aqueous
escape.

Apply com-
press and
atropine.

If the staphyloma does not yield to this treatment within a fortnight or three weeks, it will be well to put the patient under the influence of chloroform, and then snip off the protrusion with a pair of sharp scissors. A strong solution of atropine must subsequently be dropped into the eye, and a firm compress and bandage applied, and retained in its position till the wound in the cornea has healed.

or remove
with scis-
sors.

2. If the staphyloma is a large one—involving, say, a quarter or more of the cornea, we must resort to an iridectomy, as the surest means of treatment under these circumstances. If this be neglected, it is very probable that the iris and pupil will subsequently be drawn into and become attached to the cornea; we anticipate this evil, by excising at once a fourth of the iris from behind the clearest portion of the cornea, we release the iris from its attachment, and by diminishing its secreting surface lessen the quantity of aqueous formed, so that we may hope, by the careful application of a compress and bandage subsequently to the iridectomy, to reduce the dimensions of the staphyloma itself; and beyond this, prevent glaucomatous changes from taking place in the eye.

2. If large,
excise iris.

Aqueous
lessened.

Besides the immediate advantages to be derived from this proceeding, we must bear in mind the fact, that if the iris becomes permanently involved in a staphyloma, it may give rise to sympathetic irritation in the other eye; this is therefore an additional reason for resorting to iridectomy in this class of cases as early as possible.

3. If old and large, apply atropine.

Iridesis, if pupil free.

Iridectomy, if pupil closed.

Advantages of iridectomy.

3. In instances of large and old staphylomata, in which a portion of the cornea remains transparent, a similar plan of treatment must be adopted. In the first place, it will be necessary to apply atropine to the eye, in order that we may discover the state of the pupil, whether it remains partially open, or has been entirely occluded and dragged into the staphyloma. In the former case, it will dilate under the influence of atropine, and, if practicable, we must form an artificial pupil.

On the other hand, supposing the pupil has been dragged into the staphyloma, it follows that the communication between the anterior and posterior chambers of the eye will have been closed; hence, fluid collecting in the latter will cause abnormal pressure upon the retina and deeper structures of the eye, which, unless relieved, will certainly terminate in total loss of vision.

Under these circumstances we have before us a choice of two proceedings: either the formation of an artificial pupil, or else an iridectomy. I prefer the latter, because in many cases of the kind, the artificial pupil does not establish a sufficiently free communication between the chambers of the eye to prevent the occurrence of intra-ocular pressure; and secondly, because we often find, after making our artificial pupil, that we have to deal with an opaque lens behind the iris. Now, by performing an iridectomy, we not only open a free communication between the chambers of the eye, but having excised the iris (the patient being under the influence of chloroform), we may, if the lens is opaque, proceed at once to remove it by means of the scoop operation.

I should weary the reader were I to attempt to describe the numerous operations proposed with the very simple object of removing a staphyloma of the cornea. All that is necessary, however, is to excise the protuberance, and allow the contents of the globe

to escape, after which the eyeball will contract and form a good stump on which to rest an artificial eye. Among other proceedings for the removal of a staphyloma, the following may be mentioned:—

If the staphyloma is extensive, but confined to one part of the cornea, we may destroy it in the following manner:—The base of the projection is to be transfixed by two needles at right angles to one another, and the staphyloma is then to be surrounded with a silk ligature, which is prevented from slipping up by means of the needles; these should be cut off close to the points of puncture. A pad and bandage is subsequently applied, and in three or four days the staphyloma may be expected to fall off, leaving a good stump for an artificial eye.

Removal by ligature.

4. In instances of staphylomata, involving the whole of the cornea, and being an inconvenience to the patient, not only on account of their unsightly appearance, but also by interfering with the action of the eyelids (Fig. 24), we may remove the protuberance in the following way:—

FIG. 24.

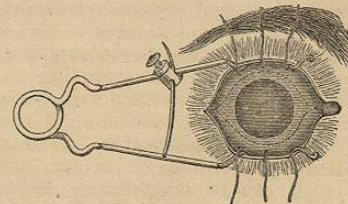


4. Abscise a complete staphyloma.

Operation of abscission.

The patient having been placed under the influence of chloroform, a stop speculum is adjusted, and the surgeon transfixes the globe of the eye, in a line corresponding to the ciliary processes, with a couple of needles, armed with a stout silk suture (Fig. 25). The staphyloma is then to be secured with a pair of toothed forceps, and that

FIG. 25.



part of the globe of the eye anterior to the suture is to be removed with a knife or a pair of scissors. The ends of the suture are then to be tied, so as to bring the edges of the wound in the sclerotic together, the speculum removed, and water-dressing applied to the eye. In the course

of a few days, the suture may be taken away, and the edges of the wound in the sclerotic will have united.

Mr. Critchett's operation.

Mr. Critchett, who first introduced this operation, called Abscission of the eyeball, transfixes the globe, immediately behind the limits of the intended incision, with four or five delicate curved needles, armed with black silk, and he does not withdraw the needles until he has abscised as much of the eye as is necessary, the presence of the needles preventing the escape of the lens and vitreous. "In the large majority of cases," he observes, "union takes place by the first intention. I generally leave the sutures in for some weeks. Sometimes they come away spontaneously."* In my own practice I have entirely discontinued the use of sutures, but in cases of complete staphyloma I am in the habit of seizing the staphyloma with a pair of toothed forceps, and simply incising the anterior hemisphere of the eyeball, the contents of the globe are allowed to escape; and then, without attempting to close the wound in the sclerotic with sutures, apply cold water dressing for a few days, with a light compress over the closed eyelids. I find this proceeding causes less irritation, is less painful, and produces an equally good stump for an artificial eye as the above described proceeding of abscission. I have never seen hæmorrhage, which could not easily be controlled by pressure, follow an operation of this kind, and there is far less chance of suppuration of the globe of the eye than when sutures are passed through the sclerotic.

Abscission when preferable to excision.

With regard to the circumstances which render the operation of partial abscission preferable to total excision of the eyeball, in cases of complete staphyloma of the cornea, I cannot do better than quote from Mr. Lawson's work. He says, "My own feeling is, that to the wealthy, where personal appearance is a source of serious moment, the operation of abscission is most valuable, as the patient can keep a watch over the stump, and seek medical aid the moment any unpleasant symptoms arise; so that if at any time it should give trouble or become dangerous to the other eye, it can be immediately removed. To the poor, however, where safety stands so much before symmetry,

* *Ophthalmic Hospital Reports*, vol. iv. p. 8.

and where neglect of early symptoms is the rule rather than the exception, it is better to remove the staphylomatous eye entirely, rather than to abscise the front of it."*

FISTULA OF THE CORNEA is an occasional sequence of ulceration, the opening through the cornea usually taking an oblique direction, and being prevented from healing by the constant drain of aqueous through it.

No sooner does perforation of the cornea take place, than the iris and lens are thrust forward, and should the capsule come in contact with the internal opening in the cornea, it is likely to give rise to partial capsular cataract. But even more serious consequences may be expected to follow if the fistula remains open; for the constant dribbling away of the aqueous diminishes the intra-ocular pressure, and gives rise to anomalies in the circulation through the choroid and retina, terminating, probably, in extensive disease of the fundus of the eye. Anterior synechia, again, may form in instances of fistula, from the contact of the iris with the cornea; and when this has taken place, irritation of the iris is apt to be induced, and extending to the choroid may compromise the eye, and involve the sound one by sympathetic irritation.

May cause capsular cataract,

and other intra-ocular changes.

A fistula of the cornea may arise from other causes than ulceration, as for instance a penetrating wound which has been prevented from entirely closing by the drain of aqueous through it. But from whatever cause produced, the fistula may at any time lead to complications such as those I have mentioned above.

Causes.

We can seldom overlook the existence of a fistula of the cornea; its external orifice may generally be clearly seen, a minute drop of aqueous oozing through it, when gentle pressure is made on the globe of the eye. The depth of the anterior chamber is much diminished, and in many instances the iris is thrust forwards against the posterior surface of the cornea.†

Appearance.

Treatment.—These fistulous openings in the cornea

Treatment.

* "Injuries of the Eye, Orbit, and Eyelids," by G. Lawson, p. 98.

† "Traité des Maladies des Yeux," par A. P. Demours, tome i. p. 308.

are difficult to heal, on account of the drain of aqueous through them; the lens, moreover, being thrust against the internal orifice of the cornea, keeps up irritation in the part, tending yet further to interfere with the healing of the fistula.

In cases of this kind, the best plan of treatment is to administer chloroform, and having separated the lids with a spring speculum, to pass a blunt-pointed needle, with a cutting edge, through the fistula, and incise the whole thickness of the cornea from above downwards, and from side to side. The edges of a crucial incision of this kind will fall into accurate apposition; and if a compress and bandage be carefully applied, it is more than probable they will heal in the course of forty-eight hours, and the fistula be cured.

I need hardly remark that too great care cannot be taken to avoid wounding the lens or iris with the point of the needle. This may generally be managed on account of the oblique direction of the fistula; moreover, with the patient well under the influence of chloroform, and laid on his back, the lens falls away from the cornea, and thus materially lessens the difficulty.

M. Wecker considers that in these cases of fistula the edges of the inner orifice, formed by the posterior elastic lamina and its epithelium, are often everted, and lining the passage, prevent union; and he therefore recommends the introduction through the fistula of a pair of very fine forceps with smooth points, by which the walls of the fistulous track are to be seized, the lining of it bruised, and the proper corneal tissue denuded. Atropine is then to be applied, and a compress and bandage worn.* In this proceeding care must be taken not to injure the capsule of the lens.

Before resorting to this treatment, we may be inclined to try what a simple compress and bandage, applied over the eye, will do, a solution of atropine at the same time being dropped into it twice a day, in order, if possible, to dilute the pupil. In addition to this somewhat expectant plan of treatment, the external orifice of the fistula may be touched with a finely-

Crucial incision in cornea,

and compress.

Avoid lens and iris.

Another operation.

Compress and bandages. Atropine.

* *Ophthalmic Hospital Reports*, vol. v. p. 395.

pointed pencil of dilute caustic every two or three days; but I would not advise much time to be expended on this kind of treatment; it seldom succeeds, and it is probably better, in most instances, to divide the fistula as soon as possible by a crucial incision, such as I have above described.

Iridectomy has been recommended in these cases, but I can hardly think it necessary, unless the fistula be complicated with traumatic cataract, in which case the principles of treatment will be discussed under the head of injuries of the lens.

OPACITIES OF THE CORNEA.—Opacities of the cornea vary greatly in extent and density, as well as in their permanency, according to the circumstances which have given rise to them. The opaque condition may amount only to a milky cloudiness, extending over the whole cornea, or confined to certain portions of it; and which again may be limited to the superficial layers, or occupy the substance of the proper corneal tissue. In other cases, as where it has resulted from the process of repair, following considerable loss of substance in the cornea, the opacity is much denser, and has more or less the character of an adventitious formation or cicatrix. The denser varieties of opacity are usually described as *leucoma*; hazy, semi-opaque forms are called *nebulæ*.

The more superficial opacities are due to a fatty, molecular cloudiness of the epithelial cells, and generally arise from superficial keratitis, ulceration, or mechanical irritation of the cornea. The deeper varieties, which occupy the substance of the proper corneal tissue, result from the proliferation of the corneal cells, occurring in the progress of keratitis which has not been confined to the epithelial layers. The loss of transparency which remains, when all active disorder has ceased, appears to be due, partly to the presence of groups of shrunken nuclei, partly to a molecular fatty degeneration of the intercellular material: such are the flaky opacities of interstitial or syphilitic keratitis. Lastly, where there has been considerable destruction of corneal tissue from ulceration or other injury, and the gap has been filled by new formation, although transparent corneal fibres are reproduced under favourable circumstances, yet

Dilute caustic pencil.

OPACITIES OF CORNEA.

Varieties.

Leucoma and nebulæ.

Kinds and degrees of structural change.

the process is incomplete and confined to the deeper parts, while those towards the surface acquire more or less the character of an opaque fibrous or cicatricial tissue.

Limits of restoration.

In the epithelial and interstitial opacities, which depend on the presence of degenerate cellular and intercellular products, these may in time be cast off or absorbed, and their place supplied by a higher formation: hence these opacities often clear away more or less completely, and we shall have the better reason to expect such a result the more recent the affection, and the younger and more vigorous the patient. On the other hand, whenever there has been considerable loss of corneal substance, which has been replaced by cicatricial tissue, restoration of transparency is impossible. Such new formations, however, are often surrounded by a margin of cloudy opacity, which may clear away spontaneously.

Cicatrices never transparent.

Prognosis.

Artificial pupil the only remedy in leucoma.

Prognosis.—The chief points for consideration, in forming a prognosis in instances of opacity of the cornea, are the situation and extent of the structural changes that have taken place. For the reasons already stated, a dense leucoma can never be removed, and if it be situated in the axis of vision, our main hope will rest in forming an artificial pupil should any part of the cornea remain transparent. If the leucoma on the other hand is eccentric, and the pupil is in its normal position, the opacity will be of comparatively little consequence. It generally happens, however, that the border of a leucoma shades off into a nebulous area, and if this extends in front of the pupil, it may be almost as detrimental to the perfection of vision while it lasts, as a more dense opacity would be.

Nebulae may clear off or shift.

In the case of nebulae, where the cause which gave rise to them is no longer in operation, nutrition vigorous, and the patient young, we may confidently look for a spontaneous disappearance or great diminution in the opacity; but this must always be a work of time. Some varieties of nebulae, more especially those which are the result of syphilitic keratitis, are apt to shift from one part of the cornea to another, and a change of position, with regard to the axis of vision, may greatly modify their effect on the sight. If situ-

ated in the deeper layers of the laminated tissue, or in the posterior layer of the cornea, nebulae may be easily overlooked, unless the part is carefully examined by the lateral method of illumination. We cannot, therefore, be too careful in exploring these parts, when dimness of vision is complained of; for opacities, though so faint that they are with difficulty detected, may be enough to scatter the transmitted light, and so offer very serious embarrassment to distinct vision, and be a constant source of annoyance to the patient.

Nebulae easily overlooked.

Yet greatly hinder vision.

Slight opacities of the cornea, if of long duration, may induce myopia. The haziness of the transparent media, by diminishing the clearness of the visual image, causes the patient constantly to exert his accommodative power in vain efforts to attain distinct vision, and this ultimately leads to hypertrophy of the contractile tissue which determines the curvature of the lens; its anterior surface thus remains abnormally convex, and the result is a permanent myopia, although the opacity of the cornea may subsequently clear away.

May cause myopia.

Strabismus, again, is occasionally a result of central opacities of the cornea, the strain of accommodation, and associated increased action of the internal rectus muscle, inducing strabismus of the weaker eye. This tendency is augmented by the necessity that exists of excluding from binocular vision the eye which is clouded, in order to maintain the most distinct impressions when fixing an object. Should the opacity continue for any length of time, the sensibility of the retina may be destroyed, and the eye rendered useless for optical purposes. But myopia and strabismus are rare complications of corneal opacity; the patient usually complains simply of dimness or loss of vision, depending on, and proportional to, the position and density of the opacity of the cornea.

or strabismus.

The Causes which give rise to opacities of the cornea are numerous. Glaucoma, for instance, may render it hazy, the changes which occur in the choroid affecting the long ciliary nerves, and hence impairing the innervation and nutrition of the cornea. In certain forms of iritis, the posterior layers of the cornea are often involved, and this may give rise to opacities in that situation. Keratitis punctata, and the various forms

Causes.

Glaucoma.

Iritis.

Keratitis.

Chemical agents.

Illustration.

Wounds and injuries.

Treatment.

Artificial pupil in leucoma.

Nebulae often get well.

of inflammation and ulceration of the cornea, are frequent causes of leucoma or nebulae.

Chemical agents again, by destroying the vitality of the tissue, may induce opacity of the cornea. Acetate of lead, applied as a lotion to the eyes, by chemical decomposition with the lachrymal secretion, may be converted into carbonate and become deposited on the cornea in the form of a permanent opacity, especially if its surface happens to be ulcerated or uneven at the time the lotion is used. In like manner, nitrate of silver may, in the course of time, stain it almost perfectly black. I have at present an old lady under treatment who was ordered, many years ago, nitrate of silver drops for her left eye; she went on using the lotion for a long time, until, in fact, she had stained the cornea and conjunctiva of so dense a black, as entirely to conceal the iris and pupil. The eye has been in this state for twenty years, without the slightest sign of improvement—a tolerably good proof that the laminated tissue of the cornea does not undergo disintegration and removal so rapidly as some persons have supposed. Opacities of the cornea, again, may be induced by the deposit of calcareous matter on its surface.

Wounds and injuries, which cause loss of substance, must, in healing, give rise to leucoma, while slight mechanical violence may be followed by only temporary opacity. But of all these causes of loss of transparency, ulceration, and mechanical irritation from disease of the palpebral conjunctiva, are by far the most frequent and influential.

Treatment.—In cases of leucoma, as I have already remarked, it is impossible, by any remedial agencies, to remove the opacity. We may often do much towards restoring the patient's sight by means of an artificial pupil, but so far as the cornea is concerned, it is useless to attempt improvement. If the leucoma is of recent formation, it is very possible that the hazy rim of cornea which usually surrounds it will gradually disappear, and thus the extent of opacity diminish.

In cases of nebulae, time and nature will often effect a cure, especially among young people; but we may sometimes hasten the process by local applications. I usually prescribe, in the absence of irritation, a lotion containing one grain of iodine, and two of

iodide of potassium, in an ounce of water, a few drops to be applied to the eye every morning. Should this lotion cause any irritation, it must be discontinued at once.

If the opacity is superficial, the cornea should be dusted over with calomel every other morning. The dilute red oxide of mercury ointment, weak astringent lotions, and in fact a multitude of so-called specifics, have been employed from time to time to cure these opacities of the cornea. If there is any irritation about the eye, the extract of belladonna may be smeared over the lids, and a light pad and bandage applied, so as to keep it at rest.

Opacities of the cornea arising from stains, such as that caused by nitrate of silver, can hardly be removed; a weak solution of cyanide of potassium has been recommended and may be tried for want of any more efficient plan of treatment. The opacities produced by deposits of carbonate of lead are more manageable. The patient must be placed under the influence of chloroform, and a stop speculum having been applied, so as to separate the lids, the eye is to be fixed with a pair of forceps, and the surgeon may then scrape off the deposit of carbonate of lead from the laminated tissue of the cornea; this can be managed either with an instrument that has been invented for the purpose, resembling a miniature goff-club, or a broad needle will answer the purpose equally well. A few drops of oil should be dropped into the eye after the deposit has been removed, and the lids kept closed with a pad and bandage for a few days.

Leucoma, caused by chemical agents such as lime, or by mechanical injuries, which have destroyed a portion of the cornea, differs in no respect from that caused by ulceration.

Traumatic cases are frequently complicated with lesions of the lens, and their management will be more fully described under the head of cataract. In some very exceptional instances of central opacity of the cornea, it may be possible to give the incident rays of light an eccentric direction by means of prismatic glasses, and thus improve the patient's binocular vision. Under the heading of "artificial pupil," the reader will find rules relating to the formation of an artificial pupil in cases of opacity of the cornea.

Iodine drops.

Calomel. Ung. hyd. ox. rub.

Bella-donna.

Pot. cyan. for silver stains.

Lead deposits scraped off.

Prismatic glasses.

Calcareous opacity

to be removed.

Apt to re-form.

Tattooing cornea.

CONICAL CORNEA.

Before leaving this subject, I would refer to a form of opacity of the cornea described by Mr. Bowman.* It consists of a deposit of earthy matter on the surface of the cornea, which appears "very finely mottled with dark dots, some of which are only to be seen with a lens; its margins are shaded off rather abruptly, and the cornea beyond them is perfectly clear. The opacity has the appearance of occupying a superficial position and of being very slightly raised, but the surface reflects the light as brilliantly as other parts of the cornea." These opacities come on gradually, and are caused by a deposit of the salts of lime beneath the epithelium of the anterior layer of the cornea; they may be detached in the way already described in the case of carbonate of lead, and I have successfully removed the whole of the opaque mass in several instances. Deposits of this kind are very apt, however, to re-form, and often cause the patient incessant irritation and trouble; so much so, that in an instance recently in the hospital, I found it ultimately advisable to perform abscission, removing the entire cornea, on account of the protracted irritation produced.

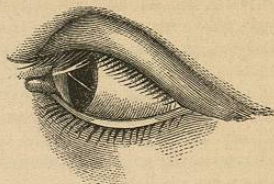
De Wecker not long since proposed to tattoo opaque spots in the cornea; and there can be no question as to the fact of this proceeding not only improving the appearance of the affected eye, but also diminishing the diffusion of light thrown on the retina in instances of opacity of the cornea. The operation of tattooing the cornea is performed as follows:—The lids having been separated with a speculum and the globe of the eye fixed, a number of small oblique punctures are made into the cornea with a sharp-pointed hollow spud, or needle, which has been dipped in fluid Indian ink. The speculum should be left in the eye till the ink has dried in the cornea. The operation may have to be repeated several times until the requisite amount of the white spot in the cornea has been dyed black.

CONICAL CORNEA consists in a thinning and bulging outwards of the whole or a part of the cornea, without loss of transparency. It sometimes appears as an

* "Lectures on the Parts Concerned in the Operations on the Eye," p. 117.

abrupt cone, rising from the centre of the cornea, or a transverse protuberance may be eccentric; but as a general rule, the whole of the cornea is involved, its centre forming the most prominent part of the cone (Fig. 26). It necessarily follows, under these circumstances, that the refraction of the rays of light on entering the eye is greatly increased, and they are brought to a focus anterior to the retina; the patient is therefore myopic. As a general rule, the disease appears between the ages of fifteen and twenty-five, but it may commence earlier, or as late as fifty years. It does not occur as a sequence of inflammation, but more commonly manifests itself in weak and sickly subjects, and generally progresses with equal rapidity in both eyes, though it may advance more rapidly in one than the other.*

FIG. 26.



In conical cornea, although the protuberance is often considerable, the cornea never gives way; it seems probable that as the laminated tissue becomes thinner it allows of a freer transudation of aqueous fluid through its substance than in health, and the intra-ocular pressure being thus relieved, there is not the same tendency that there otherwise would be, for the attenuated tissue to rupture, and give exit to the contents of the eyeball. There can be no doubt of the fact, that as the first step in this change, the laminated tissue of the cornea yields to the intra-ocular pressure, apparently from an inherent weakness in its fibrous structure; but that when the consequent attenuation has reached a certain limit, the balance is restored by exosmosis, and further distension prevented. These alterations in the resisting powers of the fibrous layers of the cornea advance most rapidly in its central portion, and degenerative changes occasionally occur in this situation, which render it more or less opaque; but with this exception, notwithstanding the very re-

Causes myopia.
Cornea never gives way.
Due to primary weakness of tissue.

* *Ophthalmic Hospital Reports*, vol. ii. p. 157, 1859.

markable alteration of form which the cornea undergoes, it remains transparent.

Progress depends on state of nutrition.

The rapidity with which the disease progresses is variable; sometimes it makes rapid strides, and in other instances takes years to advance. These variations, however, will much depend on the state of the patient's general health; any cause which impairs the nutrition of the part, or which induces congestion of the choroid, and increased intra-ocular pressure, will tend to augment the protrusion. Excluding such disturbing causes, the disease will generally advance to a certain point, and then remain stationary for years, or it may be for life.

Symptoms.

Symptoms.— Besides the alteration in the appearance of the eye, conical cornea gives rise to impairment of vision, the degree of which depends very much upon the extent to which its curvature has been altered. In the early stages of the disease, the patient probably complains of slight, but gradually increasing, myopia, consequent on the increased refraction by the dioptric media. This defect may be corrected for a time by the use of concave glasses; but as the disease advances, not only is the refraction so much augmented that concave glasses cease to rectify the evil, but even before the disease has advanced to this stage, the altered curvature of the cornea, which is seldom equal in all its planes, gives rise to astigmatism. This again, if stationary, may be overcome by the use of cylindrical glasses. Should the degenerative changes continue to progress, opacity of the central portion of the cornea gradually supervenes, and the eye is destroyed.

Astigmatism.

It is seldom possible, by light directly thrown on the part, to appreciate the slight increase in the convexity of the cornea that marks the early stages of the disease; it is necessary to employ the lateral method of examination; the bulging forwards of the central portion of the cornea will then become distinctly visible in most instances. Should any doubt on the subject still exist, the ophthalmoscope without the convex lens in front of it may be used, the light from the instrument being thrown at different angles on the cornea; the side of the cone opposite the light will then appear darkened, or cast into the shade. This test is a very delicate one, and may be relied on when simple inspection fails to satisfy us.

Examine by lateral illumination,

or ophthalmoscope.

Treatment.— Our first and obvious duty will be to supply the patient, if practicable, with concave or cylindrical glasses, at an early stage of the disease, and thus prevent, as far as possible, all straining of the eyes, which tends to produce intra-ocular congestion and increased tension of the globe. In selecting glasses, the rules ordinarily applicable to cases of myopia and astigmatism hold good.

Treatment.

Glasses.

In the second place, we must do all in our power to improve or maintain the patient's general health. Individuals affected with conical cornea, as a general rule, are wanting in natural vigour, and often require tonics. Lastly, we may lessen the secretion of aqueous, in bad and advancing cases, by iridectomy, the upper section of the iris being removed; nor should this operation be long delayed if its full advantages are to be gained, because it is by lessening the amount of aqueous, and thereby diminishing the force which distends the cornea, that iridectomy proves serviceable. I do not assert that iridectomy will stop the progress of the affection, but in its early stages it affords us the best chance we have of checking it, especially in instances where the disease is making rapid progress.

Attend to general health.

Iridectomy.

Von Graefe recommends the following proceeding in cases of advancing conical cornea. One of his narrow-bladed cataract knives is to be thrust into the middle layer of the cornea, at the apex of the cone, and then passed out again, so that a small superficial flap may be made. The anterior chamber is not to be punctured, but only the exterior layers of the cornea raised and turned back, the flap thus formed being cut off at its base with a pair of scissors. If the cornea should by chance be punctured, the operation must be put off for a few days until the wound has healed. The day after the operation, the surface from which the flap of cornea has been removed is to be touched with a pencil of dilute nitrate of silver (nitrate of silver one part, nitrate of potash two parts), at first very lightly; this proceeding must be repeated every other day until an ulcer surrounded by a halo of infiltration is produced. The anterior chamber is then to be cautiously opened through the base of the ulcer with a blunt probe. The perforation is repeated daily for three or four days, and then the eye is bound up, and the ulcer allowed to heal. The result is the flattening of the excessive

V. Graefe's Operation.