

they must be managed according to the principles of treatment detailed under their respective headings.

SUPPURATIVE  
KERATITIS.

1. Acute.

Pain and photophobia.

Congestion.

Cornea suppurates.

Onyx.

Pus gravitates.

Prognosis good if pus escapes.

SUPPURATIVE KERATITIS, including abscess of the cornea, and onyx, may be conveniently described under two heads, the acute and the subacute.

1. *Acute Suppurative Keratitis* is attended with considerable and often violent pain in the affected eye, extending to the eyebrow and temple. The patient complains of intolerance of light and epiphora; the conjunctiva is usually much congested, and often considerable chemosis exists, concealing the injected zone of vessels which surrounds the circumference of the cornea. The cornea itself is hazy, and as the disease advances suppuration takes place in its laminated structure. The pus thus formed may escape externally, giving rise to an ulcer, or may burst into the aqueous chamber; or, lastly, it may gravitate downwards between the layers of the cornea to its inferior section, forming a yellow opaque patch, resembling in form and size the white mark seen at the root of the finger-nails, and hence the term onyx. The superior border of this collection of matter is convex, and being situated between the layers of the cornea, it does not change its level as an hypopion does, when the patient bends his head over on one side. The collection of pus resulting from this form of keratitis seldom reaches as high as a line corresponding to the lower margin of the pupil.

The formation of pus occurs as frequently in the upper as in the lower section of the cornea; but in either case the result is the same. If it does not escape it descends to a lower level, either among the corneal fibres or between the laminated structure and posterior layer.

The course which this disease pursues much depends on the situation of the abscess; if it be superficial, the pus makes an opening for itself externally, and comparatively little injury is done to the cornea; the pressure of the aqueous from behind not only tending to force the matter outwards, but also to keep the walls of the abscess in apposition when empty, so that the cavity occupied by the pus is thus effectually closed; and beyond a slight hazy appearance of the part, no vestiges of the disease may remain. Should it happen,

however, that the haziness, though slight, is in the axis of sight, the patient will probably complain grievously of the impairment of vision which it produces.

If, on the other hand, the abscess is situated deeply in the laminated tissue of the cornea, the consequences may be most serious. The matter thus pent up is prone to spread among the corneal fibres, and inflict irreparable damage on its structure; or it may force its way between, and separate the posterior elastic lamina from its attachments. The chances of its finding a free vent into the aqueous chamber, through the posterior elastic lamina, are small, for an opening in the latter membrane is immediately closed by the outward pressure of the aqueous. Under these circumstances the diseased action will very probably spread to the iris and deeper structures of the eye. In cases of this kind, we can generally make out the condition of the parts by the lateral method of examination; the posterior layer of the cornea will be seen bulging backwards, and often touching the iris, and flakes of lymph and pus may usually be observed floating about in the muddy aqueous humour. The fibrous structure of the iris will be more or less hazy, and the pupil, in all probability, will refuse to dilate when atropine is applied to the eye; or if the iris does act, the pupil may assume all manner of shapes from the existence of anterior synechia. Under these circumstances, the pain in the eye and side of the head, from which the patient suffers, is often excruciating.

The prognosis, then, in this second class of cases, is most unfavourable, for if the posterior elastic lamina be involved, general inflammation of the globe of the eye may at any time be excited. In other cases, the suppuration and destruction of the cornea continue until it can no longer resist the intra-ocular pressure, and the degenerated structure gives way, the contents of the eyeball escape, and the eye collapses; or if the rent in the cornea has not been very considerable, prolapse of the iris and a staphyloma may occur.

The *Treatment* of abscess of the cornea must be conducted upon the same principle as that of a similar collection of matter in any other part of the body. If the pain and ciliary neurosis are very great, as is usually the case, warm fomentations may be con-

Bad if retained.

Cornea destroyed.

Danger of spreading to iris.

Signs of iritis.

Suffering great.

The eye may be lost.

Treatment.

Foment.  
Morphia.

stantly employed, and the subcutaneous injection of morphia beneath the skin of the temple must be resorted to. A solution of atropine should be applied to the eye every six hours.

Open ab-  
scess.

Whenever matter forms in the cornea, the sooner we make a depending opening into the part the better, so as to allow the pus to escape externally. In some instances the matter is thick and cheeselike, and will not readily flow through the incision in the cornea; if this is the case, a small scoop should be introduced into the abscess, and its contents evacuated. Our incision in the cornea should take an oblique direction, to avoid the risk of running the point of the instrument into the anterior chamber, which is very undesirable, because the presence of the aqueous is most serviceable in keeping up pressure from behind, and forcing the pus out through the external opening which we have made in the cornea.\* There is generally little fear of this accident happening, for the posterior elastic lamina bulges backwards, leaving space between the middle and posterior layers of the cornea to allow of our being able to manipulate with freedom.

Avoid the  
anterior  
chamber.

Chloroform  
necessary.

I am in the habit of always administering chloroform in operations of this kind: it seems to me otherwise almost impossible to command the patient's eye, and open the abscess with due precision. The patient generally experiences great relief when the matter has been allowed to escape; subsequently hot poppy-head fomentations may be used three or four times a day, and in the intervals an ointment composed of morphia, belladonna, and Indian hemp should be smeared over the eyelids, and the eye kept closed with a light pad and bandage.

See datives  
and rest.

Atropine  
in iritis.

Should it appear that the iris has become involved, the treatment of the abscess in the cornea must still be conducted upon the principles above detailed; but we shall have to use frequent instillations of atropine, in order to dilate the pupil as speedily as possible. If the destruction of the cornea continues, and more particularly if the iris dilates irregularly under the influence of atropine, it may be necessary to perform iridectomy, and the sooner we resort to this operation,

Iridectomy.

\* "Traité des Maladies des Yeux," par A. P. Demours, t. i. p. 281.

under these circumstances, the better. I have but little faith in simply opening the anterior chamber and evacuating the aqueous fluid in cases of this kind.

In some instances of suppurative keratitis, the tendency of the affection is to spread rapidly from the original seat of the disease, and yet the pain and irritation in the eye may have subsided. In this very dangerous class of cases, the chlorine water is a useful local application; it should be dropped into the eye three times a day, and a firm compress and bandage applied for four or five hours, but this must be discontinued, or the pressure lessened, if it increases the pain in the eye. Warm fomentations are very useful, unless there be considerable congestion and chemosis of the conjunctiva, in which case they are apt to augment the blood stasis, reducing still further the already defective supply of nutritive material to the cornea, and consequently hastening its destruction.

Chlorine  
water.

Fomenta-  
tions.

2. *Subacute Suppurative Keratitis* differs from the acute form of the disease, in that there are no appearances of inflammatory action in the part, nor does the patient complain of pain or photophobia, except from complications hereafter described.

2. Sub-  
acute form.

It is most commonly met with among persons in a debilitated state of health; we see it for instance after cholera, starvation, or small-pox, especially among children, and it then pursues a very rapid course. The disease commences with the appearance of one or more yellow-looking patches of suppuration, situated in the laminated tissue of the cornea; these spots extend themselves rapidly, they coalesce; and in the course of a few days, or it may be hours, a considerable portion of the cornea is involved, and a collection of pus will have taken place in its lower part.

In debility

Yellow  
corneal  
patches.

Abscess.

The further course of the disease depends very much upon the extent and rapidity with which the degenerative changes progress, and also upon the position of the accumulated matter. If the pus has formed in the anterior layers of the cornea, the abscess may burst externally; but should it occupy the deeper layers, so as to involve the posterior elastic lamina, it is very probable that the diseased action will extend to the iris and deeper structures of the eye. The conjunctiva is then usually much congested, and the de-

May burst  
externally.

struction of the cornea frequently progresses very rapidly.

*Treatment.*  
Support the  
strength.

The *Treatment* to be followed in these cases must be directed towards the restoration of the nutritive powers of our patients, so as, if possible, to stay the decay and death of the cornea. In all probability we shall have to resort to stimulants, a highly nutritious diet and tonics. Among the latter, the tincture of muriate of iron, given in twenty minim doses, with a grain of sulphate of quinine, every six hours, will sometimes be beneficial.

Open ab-  
scess.

Atropine.

Compress,  
and aq.  
chlor.

Should a collection of matter take place in the cornea, it must be evacuated as soon as possible, in the manner already described. Atropine must always be employed, particularly during the early stages of this disease. These cases beyond all others are influenced by a compress carefully applied over the eye, chlorine water being also employed. With regard to the compress, it is seldom likely to do good if it causes much pain in the eye, we must then slacken the bandage or leave it off for several hours during the day, and if there is not much conjunctival congestion, we may then employ the poppy-head fomentations. Unfortunately our best efforts are too often unavailing, the destructive changes in the cornea advancing so rapidly, that we have no time to improve our patient's health. The affection, moreover, having a constitutional basis, both eyes are often involved, so that the condition of the patient is indeed a most hopeless one.

Iridectomy,

Should other means fail, and the destruction of the cornea continue to advance, we are not only justified in performing iridectomy, but it is our bounden duty to do so at once, provided any portion of the cornea remain transparent. Under these circumstances it is advisable to remove about one-fourth of the iris from behind the transparent part of the cornea. Thus, supposing the lower half of the cornea has been destroyed, and its upper part is still transparent, we need not hesitate to make an opening into the anterior chamber through the superior part of the sclerotic, and remove at least a fourth of the iris. I do not attempt to explain the *modus operandi* of iridectomy under these circumstances, but I can assert most positively my conviction, that I have often seen a patient's sight saved by this proceeding, when no other prospect

its great  
value.

seemed to remain, but certain and incurable blindness; nor do I think it advisable to attempt to relieve symptoms of this kind by simply resorting to the operation of paracentesis of the cornea; valuable time may thus be thrown away and iridectomy perhaps delayed until it is too late to do any good.

*Keratitis from Nervous Lesions.*—In concluding this subject, I may briefly refer to a form of suppurative keratitis, which arises from defective innervation of the cornea, in consequence of which its nutrition is impaired, and degenerative changes, such as those above described, occur. The most common cause of this form of the disease, are wounds or injuries affecting the superficial branches of the fifth nerve. Thus we occasionally see rapid destruction of the cornea take place, apparently from the irritation caused by a foreign body lodged in the folds of the conjunctiva. Injuries affecting the origin or trunk of the nerve may induce a similar train of symptoms, which when once begun generally defy all our efforts to stop their progress.

Keratitis  
from  
nervous  
lesions.

In cases arising from peripheral irritation of the nerve, we may, by the removal of the cause, put a stop to its injurious effects on the cornea. M. Snellen considers that in the analogous case of ulceration of the cornea, apparently arising from injury of the fifth pair, it is from the particles of dust and dirt which then find their way into the eye, that the destructive changes arise. He asserts that if, after injury of the nerve, the eyelids are kept perfectly closed, should ulceration occur at all, it is very partial in its effects.\*

Remove  
cause.

Protect the  
eye.

Dr. Sinitzin, on the other hand, considers that after injury to the fifth nerve, neuro-paralytic phenomena occur whether the eye is protected or not; he states that, having studied the effects of ablation of the superior cervical ganglion of the sympathetic nerve upon the eye in a large number of experiments, he has arrived at the following results:—1. Immediately after the ablation of this ganglion, increased vascular injection was constantly observable in the fundus of the eye of the same side. Ophthalmoscopic examination showed that the choroidal vessels had increased

Sinitzin's  
experi-  
ments.

Removal  
of cervical  
ganglion.

Hyperæmia  
of fundus.

\* *Annales d'Oculistique*, t. liii. p. 178; see also a case strongly confirming this view by Mr. Hulke, *Ophthalmic Hospital Reports*, vol. v. p. 177.

Increased heat.

Reaction on irritation lessened.

Effects of section of 5th prevented.

in size, that their anastomoses had become much more distinct, and that in general the fundus was of a much deeper red on the operated, than upon the sound side. 2. The temperature of the eye of the operated side rose. In the sac of the conjunctiva and beneath the capsule of Tenon the difference in temperature amounted to as much as  $0.9^{\circ}$  to  $2.4^{\circ}$  Cent. 3. The cornea of the side operated upon possessed, when compared with the other, a much greater capability of resistance to the action of foreign and neutral substances. If, for instance, a fine spiculum of glass was inserted to an equal depth into each cornea, it always happened that, whilst on the sound side the spiculum excited more or less violent conjunctivitis, pannus, purulent infiltration of the cornea, with subsequent ulceration and ultimate disintegration of the adjoining tissue, or a more or less severe iritis and threatening of panophthalmitis—on the operated side either scarcely any reaction occurred, which was most commonly the case, or at most it was but slight. It was also observable that, as Claude Bernard has shown, the stronger the animal the greater the difference in the temperature, and the sooner after the operation the foreign body is inserted the greater is the resistance exhibited by the sound side. 4. The well-known neuro-paralytic phenomena consequent upon section of the fifth nerve in the skull, immediately in front of the Gasserian ganglion, do not occur if shortly before this operation, or immediately after it, the cervical ganglion is removed. 5. Even when some of these neuro-paralytic phenomena have made their appearance after section of the fifth, ablation of the ganglion will cause them to vanish in the course of a few (two to four) days. 6. Such disappearance is possible so long as the surface of the cornea remains moist and polished; if these conditions have supervened, separation of the epithelium, haziness of the cornea, as well as injection and swelling of the iris, they will no longer disappear. 7. The complete atrophy or destruction of the eye consequent upon section of the fifth may still be staved off if the ganglion be removed during the progress of the changes, the conditions present either remaining *in statu quo* or undergoing more or less improvement. 8. The ulceration of the lips, especially of the lower one, following section of the fifth, as well as the ulceration of the eyelids, completely vanish after section of the

sympathetic. 9. For the improvement taking place under the four last heads it is not requisite for the animals to have any special protection from injury afforded. In Dr. Sinitzin's opinion, the neuro-paralytic phenomena after division of the fifth occur whether the eye of the side operated on is protected from irritation or not. 10. The diminution of temperature, observed by various experimenters on the same side after section of the fifth, never occurs when ablation of the sympathetic ganglion has been simultaneously performed. Dr. Sinitzin says that the changes in the circulation appear to be at the bottom of these effects. Ligature of the carotid, or irritation of the depressor nerve of the heart, neutralizes the inhibitory effects of the ablation of the sympathetic ganglion upon the neuro-paralytic phenomena consequent on section of the fifth.\*

Protection of doubtful efficacy.

The treatment in these cases, when suppuration is established, is to be conducted upon precisely the same principles as in the case of abscess; it may be necessary to perform an iridectomy in order to save the transparent portion of the cornea.

Iridectomy.

#### ULCERATION AND ITS CONSEQUENCES.

ULCERATION OF THE CORNEA may be conveniently considered for descriptive purposes under two heads, the acute and subacute, or sthenic and asthenic forms. We must bear in mind, however, that in practice we shall frequently meet with cases where it is difficult or impossible to say to which class they belong, the line of demarcation between acute and subacute ulceration being by no means a definite one; nor is the distinction of much importance in a practical point of view.

ULCERS OF CORNEA.

General considerations.

As a general rule, it may be affirmed, that ulceration of the cornea differs from ordinary keratitis in the loss of substance it occasions, and in the nature and result of the reparative process by which a cure is effected. Thus it frequently happens in the case of ulceration, that the cornea is permanently injured, and sometimes its transparency entirely destroyed, either by the formation of a dense cicatrix, or from perforation and staphyloma.

Cause loss of substance.

\* *Lancet*, 1871, p. 661, vol. i.

1. Acute or sthenic.

Pain severe.

Conjunctival and scleral congestion.

Characters of ulcers.

Limited by elastic lamina.

Reparation of ulcer.

1. *Acute or Sthenic Ulceration of the Cornea* is always accompanied with great pain in the eye, and intolerance of light: these symptoms are often so severe, that it is almost impossible for the patient to open his eye, and the moment he does so, a gush of tears takes place, and the lids are involuntarily closed. The pain in these cases is often of an intermittent character, and usually increases towards bedtime, keeping the patient awake for hours together: it is by no means confined to the eye, but extends over the forehead and side of the head.

The palpebral and orbital portions of the conjunctiva are generally very much congested, and the sclerotic zone of vessels round the cornea is deeply injected. In very many instances the entire epithelial layer of the cornea is rough and hazy; but at one or more spots we shall notice that the cornea appears to have been eaten away or destroyed. The depth, extent, and situation of the ulcer will of course vary in almost every case.

The appearance also of the ulcer differs with the nature and stage of the disease; at first it looks like an opaque patch situated in the cornea, of a greyish colour; its surface is raised above the cornea, its edges shading off into the apparently healthy structure; but after a time the central portion of this spot degenerates and is thrown off, an excavation in the substance of the cornea becoming apparent. The base of the ulcer may be clear and transparent, especially if the disease has eaten down to the posterior elastic lamina, which has, apparently, considerable powers of resisting these destructive changes, and may remain perfectly clear, while the laminated tissue of the cornea above it has been entirely destroyed. The margins of these sthenic ulcers are generally well defined, but jagged and irregular, and of a greyish white colour.

As the ulcer begins to heal, we may notice that it lessens in circumference, the reparation beginning at the edges and extending towards the centre. As this process goes on, blood-vessels will be seen coursing over the cornea and passing up to the edge of the ulcer; they gradually dwindle away as the ulcer heals. No sooner do the epithelial cells re-form, than the patient experiences the greatest relief from a cessation of the pain and photophobia from which he previously suffered.

It would be impossible to describe the various forms which ulcers of the cornea assume, but there are some varieties so frequently met with in practice that they require a word or two of special notice; among these the crescentic ulcer of the cornea is not only very dangerous, but most difficult to treat. These crescentic or encircling ulcers commence at the edge of the cornea, and look very much as if a bit of the cornea had been chipped out. The ulcer has not only a tendency to extend itself round the circumference of the cornea, but also to eat deeply into its substance. The supply of nutritive material is necessarily cut off from the central part of the cornea, and it may consequently slough. These cases of ulceration, though similar in their results to those occurring in purulent conjunctivitis, may arise quite independently of inflammation of the conjunctiva.

In other cases the ulcer assumes a funnel-shape, extending deeply into the cornea, and is very apt to perforate it in spite of our best efforts.

2. *Subacute or Asthenic Ulceration* of the cornea is not characterized by pain, photophobia, or any of the more urgent symptoms of irritation noticed in the acute form of the disease; there is seldom much congestion of the sclerotic or conjunctival vessels, and the ulceration is often a very tedious process, but, fortunately, has less tendency to involve the deeper layers of the cornea, and consequently to lead to a staphyloma, than the more acute forms of the disease.

These asthenic ulcers are generally superficial; their borders are well defined and sharp, as though a piece had been punched out of the cornea. Few if any vessels will be seen running up to them from the conjunctiva; in fact, there is evidence of want of action in the part, the ulcer neither spreading nor healing, except by very slow steps, or by fits and starts.

*Prognosis.*—This will depend more upon the depth and situation of the ulcer than upon its sthenic or asthenic character. Thus, even a subacute ulcer, from its long continuance, may involve the posterior elastic lamina, and ultimately set up lesions in the deeper structures of the eye; though such complications are doubtless more liable to occur in cases of sthenic ulceration, because the latter has a marked tendency

Encircling ulcer.

2. Subacute ulcers.

Superficial and sharp.

Inactive.

Prognosis, varies with depth and seat.

to spread, not only in circumference, but also to the deeper layers of the cornea.

Risk of  
cicatrices,

central  
opacity,

and staphy-  
loma.

Effects of  
deep ulcers  
indelible.

Treatment.

Improve  
nutrition.

Again, the course of sthenic ulcers being more rapid, when once they begin to heal, reparation goes on favourably, and the prognosis, so far as the ulcer is concerned, is favourable; but whenever there has been loss of substance in the cornea, whether by acute or subacute ulceration, more or less opacity of the part will remain, as a permanent mark of the original disease; and should this opacity happen to be situated in the axis of vision, the patient's sight must remain impaired. Much may perhaps be done by forming an artificial pupil, but still the injury inflicted by the ulcer is lasting.

Unfortunately, this does not represent the whole risk of corneal ulceration: we have not only to fear the formation of a dense cicatricial tissue in deep ulcers of the cornea, but also that the attenuated cornea at the seat of ulceration may give way before the intra-ocular pressure, and that a staphyloma of the cornea and iris will occur.

The situation and depth, therefore, of the ulcer are always most important points to consider in forming a prognosis: superficial ulcers may heal, and the parts recover their normal transparency, but the effects of deep ulcers of the cornea are never overcome. Should the latter not extend to the centre of the cornea, they may still be comparatively harmless; but if, from thinning of the cornea, a staphyloma takes place, this, by involving the iris, as I shall subsequently explain, is apt to occasion the most serious mischief, if not absolutely to destroy the eye.

*Treatment.*—It will be evident from what I have just said regarding the prognosis, that our main object in treatment must be to prevent, if possible, the ulcerative process from extending either in depth or area; for such extension must result in loss of transparency in the cornea.

In most instances of ulceration (excepting traumatic cases, or those depending on conjunctivitis), the patient's general health will be found at fault;\* in no

\* "Lectures on Diseases of the Eye," by J. Morgan, 2nd edition, p. 111.

affection of the eye is it more necessary to attack the disease by improving the assimilative and nutritive functions of the body, and as a general rule, a tonic and supporting plan of treatment is demanded. Iron and quinine, good food, cleanliness, and fresh air are the fundamental requisites for the cure of almost all instances of ulceration of the cornea, whether they be of the sthenic or asthenic type. One frequently sees cases of ulceration of the cornea which resist any kind of treatment, but which rapidly improve if the patient is sent to the sea-side, or still better, for a voyage to sea.

Opium is an invaluable remedy in cases accompanied with considerable pain and irritation of the eye—in fact, in what would usually be considered acute cases. For an adult, I generally prescribe about a grain of opium twice a day, sometimes in combination with soda and quinine. At the same time, a strong solution of atropine should be dropped into the eye three times a day; and the extract of belladonna having been smeared over the temple and eyebrow of the affected eye, the eyelids must be kept closed with a light pad and bandage.

The aim of all this is to insure the diseased cornea perfect rest; the opium allays the nervous and vascular irritation, and enables the patient to sleep; the atropine retracts the iris, thereby diminishing its secreting surface, and the quantity of aqueous which is formed, and this, by lessening the intra-ocular pressure, relieves the tension of the cornea. Lastly, the eyelids are kept closed, to exclude the stimulus of light, and prevent the lids rubbing against the ulcerated cornea.

We must not forget that, in numerous instances, these means alone will not suffice to cure the ulcer, but that, as I before said, change of air and a tonic plan of treatment must also be resorted to.

In instances of sthenic ulceration it is not advisable to apply nitrate of silver to the ulcer; solid nitrate of silver should never be employed in these cases. The dilute caustic pencil, in experienced hands, may sometimes with advantage be lightly passed over the surface of rapidly-spreading ulcers of the cornea; in the majority of instances, however, more harm than good is done with nitrate of silver, and as a general rule I would not advise its employment in these cases. In

Tonics,  
food, and  
air.

Atropine.

Pad and  
bandage,

to insure  
rest.

Caustic not  
to be used:

or other  
local reme-  
dies.

fact, all lotions or applications to the eye should be avoided in ulceration of the cornea, except the solution of atropine; this is the more necessary if we notice vessels passing from the circumference of the cornea to the border of the ulcer.

But it may be asked, Can nothing be done then to stop the progress and effects of a spreading ulcer, beyond keeping the parts at rest and the patient in good hygienic conditions? I believe there may. Bearing in mind what I have already stated regarding opacity of the cornea, following loss of substance, we may regard it as certain that that portion of the cornea which has been affected by such ulceration will become opaque, and consequently it matters little what becomes of the iris behind it. These considerations lead me to recommend, that in spreading ulcers of the cornea, if all other means fail, iridectomy should be performed, the iris being removed from behind the most transparent part of the cornea so that we shall subsequently have the advantage of an artificial pupil in this situation.

Iridectomy  
in rapid  
ulcers.

I have no observations to make on iridectomy in these cases, beyond those I have already made in the case of suppurative keratitis, and which are equally applicable here. The proceeding is an extreme one, and should only be resorted to in cases which have resisted all other treatment, but this operation may then be had recourse to; if judiciously employed, it relieves the patient from pain, a rapidly-extending ulcer takes on a healthy action after the operation, and the results may be most satisfactory.

Advantages  
of.

If less  
urgent  
draw off  
aqueous.

Supposing, however, that the ulcer is not advancing very rapidly, and the symptoms do not appear to be sufficiently urgent to demand so grave an operation as iridectomy, we may possibly avert the formation of a staphyloma, or perforation of the cornea, by opening the anterior chamber with a broad needle, and allowing the aqueous humour to escape. In this way we can relieve the tension of the cornea, and diminish the chances of the aqueous bursting through its attenuated structure at the point of ulceration.

Paracentesis  
of cornea.

In performing paracentesis of the cornea under these circumstances, the point of the needle should only just be allowed to pass through the floor of the ulcer into the anterior chamber, otherwise the iris, or even

the lens, may be wounded. It is by no means necessary to wait until the deeper layers of the cornea are involved before performing paracentesis; on the other hand, there is much to be gained by resorting to this operation before the deep layers of the cornea are affected, for we thus limit the opening in the cornea to that of the size of the needle we introduce, in place of having a large rent through the bottom of the ulcer. The puncture should be made with a needle, so that the aqueous may escape slowly. Under these circumstances the iris gradually moves forward as the aqueous escapes, and comes to rest against the opening in the cornea, very likely adhering to it by neoplastic formations; but these give way as the cornea closes, the aqueous thrusting the iris and lens back into their normal position. If, after puncturing the ulcer we notice, in the course of a few days, that its base is again bulging forwards and likely to burst, we must again perform a paracentesis, and we may have to repeat the operation more than twice. After each occasion on which the cornea is opened, the eyelids and temples should be smeared over with the extract of belladonna, or the atropine ointment, and the eye kept carefully closed with a light compress and bandage.

Directions.

If the ulcerative process be asthenic, want of action characterizing the disease, and few if any vessels passing from the conjunctiva to the ulcer, we may stimulate the part by hot compresses applied over the lids, for an hour, once or twice a day; or calomel, dusted over the ulcer from time to time, will be useful.

Asthenic  
ulcers.

Hot com-  
presses.  
Calomel.

In these chronic ulcers of the cornea, which are also apt to recur, it is advisable to employ a seton. A needle armed with stout silk or twine is passed through a fold of skin in the temporal region, so as to include about an inch of integument, the silk is then tied in a loop, and the wound dressed morning and evening; the seton may be kept open for a month or two.

Setons in  
chronic  
ulcers.

But if we notice that vascularization of the cornea has commenced, and is extending up to the border of the ulcer, we may safely discontinue all treatment, simply keeping the pupil dilated, and the eye closed with a compress and bandage. The process of cure will usually be greatly expedited by change of air, a

Hygienic  
measures.

well-regulated dietary, and other means tending to improve the patient's general health.

In cases of ulceration of the cornea complicated with perforation, I would refer the reader to the section on prolapse of the iris.

**HERNIA OF CORNEA.**

Elastic lamina protrudes,

as a glassy nodule.

Often bursts.

*Treatment.*

Draw off aqueous.

Apply a compress and bandage.

**HERNIA OF THE CORNEA** consists in a protrusion of the posterior elastic lamina through the outer layers of the cornea, which may have been destroyed by ulceration. This elastic lamina has considerable power in resisting destructive changes, and hence, after the laminated tissue of the cornea has been destroyed, it may remain unaffected, and being forced outwards by the pressure of the aqueous, form a little glassy-looking nodule, projecting from the corneal surface. The transparent appearance of the tumour, bulging through the jagged border of the ulcer, is sufficiently characteristic to enable us at once to recognise the nature of the disease.

From the extreme thinness of the posterior elastic lamina, it necessarily follows that, when a hernia of this kind has occurred, the slightest force applied to the eye is likely to rupture it. Hence herniæ of the cornea are of short duration, and seldom come under observation, the posterior elastic lamina usually giving way before the distending force of the aqueous, and the corneal hernia being replaced by a prolapse of the iris. It occasionally happens, however, that the hernia remains for some weeks, and gradually becomes converted into cicatricial tissue.

*Treatment.*—The patient having been placed under the influence of chloroform, and a stop speculum adjusted, a broad needle should be run through the cornea, and the instrument being tilted on its edge, the aqueous is allowed to escape slowly from the eye. The needle is then to be removed, and a solution of atropine dropped into the eye, a compress and bandage being firmly applied over the closed lids, and kept there for forty-eight hours. The eye may then be examined, but it will be better to re-apply the compress, and continue its use for some days.

The object of this treatment is to draw off the aqueous, and allow the hernia of the cornea,—that is, the posterior elastic lamina,—to resume its normal position, and then to keep it there, by means of the

compress, till cicatricial tissue shall have formed over it. It is advisable before closing the eye, in cases where there is apparently defective action in the ulcer, to stimulate its edges by touching them with a dilute caustic pencil, and then to apply the compress and bandage over the lids.

Dilute caustic.

It may be, that on opening the lids at the expiration of forty-eight hours, we find the hernia of the cornea reproduced, in which case the paracentesis must be repeated, the compressing band and the caustic pencil being again applied. This treatment will soon excite sufficient inflammation in the part, to set up material changes in the ulcer, and although a cicatrix will remain as a permanent blemish, still, its formation will prevent a prolapse of the iris with its attendant evils.

Repeat it needful.

**STAPHYLOMA OF THE CORNEA AND IRIS.**—If the resisting power of the fibrous structure of the cornea has been destroyed, or considerably weakened by the ulcerative process, the remains of the laminated tissue, together with the posterior elastic lamina, are very likely to yield to the distending force of the aqueous; and bulging forwards, to a greater or less extent, they form what is called a staphyloma of the cornea.

STAPHYLOMA OF CORNEA.

Weakened cornea bulges.

From their relative positions, it follows, that when a partial protrusion of the cornea occurs, the iris is apt to be carried forward into the protrusion. Moreover, in the majority of these cases, a small opening occurs at the most prominent part of the staphyloma, through which the aqueous drains away; or the aqueous may percolate through the attenuated portion of the cornea; in either case, the anterior chamber being emptied, the vitreous forces the lens, and with it the iris, forwards against the cornea. The iris thus frequently becomes entangled, adherent, and ultimately firmly glued down to the inner surface of the protrusion (*vide* Fig. 23,) while its outer surface acquires a coating of fibrous (cicatricial) tissue, and thus the staphyloma ultimately assumes a dense opaque appearance, and is lined by a portion of the iris.\*

The iris follows,

False coating formed.

Staphylomata of this kind vary much in size, sometimes being so large that they protrude between the

\* "Augenheilkunde," Stellwag von Carion, p. 121.