

Rupture of the sclerotic usually takes place upward and inward; the rent is from 6 to 12 mm. in length, and nearly always parallel to the sclero-corneal margin. It may also occur—though less frequently—in an outward or downward direction, and it may be irregular in shape, extending through the sclero-corneal margin. In rare cases rupture may occur in the posterior part of the globe. In that position it does not admit of positive diagnosis, but may be suspected in cases in which hemophthalmus posterior is attended with very considerable decrease of tension.

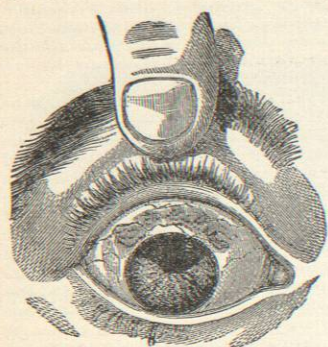


FIG. 2054.—Staphylomatous Appearance. Result of blow on the eye, which caused at the time rupture of sclera and dislocation of lens beneath the unbroken conjunctiva.

The complications which may exist are in great measure dependent on the force of the blow, and the extent to which iris, lens, or vitreous have been forced out at the time of the accident. Sometimes the lens is forcibly expelled, and may be found under the lid, or may be lost. Sometimes it may be seen at the seat of the rupture in a sac formed by the unbroken conjunctiva, where it (usually with a part of the iris) should be allowed to remain until the wound is healed and normal tension re-established. When this has taken place the iris may be removed through a suitable incision in the conjunctiva. Rupture of the sclera is usually attended by hemorrhage into the anterior chamber, often by prolapse of iris and escape of the lens.

Perfect rest is, of course, the first thing called for in the treatment of a rupture of the sclera. The patient should be confined to the room, and, if not kept in a recumbent posture, should avoid sudden movements or stooping, coughing, straining, which may lead to complications from hemorrhage into the choroid or to retinal separation. Iris or vitreous which protrudes from the wound may be removed with the scissors, if such interference can be borne without the administration of ether. If the lens is so situated as to prevent the lips of the wound from closing, or if it seems to press on the iris or the ciliary body, an attempt should be made to extract it. Atropine is usually indicated.

The prognosis in cases of rupture of the sclera is not so bad as one would be inclined to fear. Sometimes panophthalmitis, with its attendant train of destructive changes, supervenes; but often the usefulness of the eye is not entirely destroyed.

Cuts and punctures in the ciliary region are almost sure to end disastrously so far as sight is concerned. The best result that can be expected is a quiet subsidence of the immediate inflammatory action, to be followed very likely by gradual cessation of function and partial atrophy of the tissues of the globe. Suppurative iridochoroiditis is very likely to follow any punctured wound

of the sclera, even though it be situated so far back as to have escaped the ciliary region. It is not absolutely impossible that a clean cut through the sclera at the ciliary region, if made with a smooth, sharp instrument, may heal and leave a useful visual organ, but such a result is not to be expected.

The treatment for cut or punctured wounds is the same as for open ruptures. Tissues presenting themselves in the wound should be trimmed away as much as possible, without so disturbing the condition of affairs that more of the contents of the eye will be forced out to take the place of those removed. Gentle manipulation with the spatula or the scoop should be used in the attempt to leave the edges of the wound as nearly in their normal places as possible. If there is much gaping of the wound a very fine suture should be put in, if possible, through the outer edge of the sclera only; then both eyes should be kept closed and under gentle pressure. Even after the wound has healed and everything gives promise of a fair recovery, the contraction of cicatricial tissue may be the cause of retinal separations, followed or attended by gradual destruction of the wounded eye or by sympathetic trouble in the other.

Iris.—Non-penetrating wounds of the globe are sometimes the cause of a rupture or a tear of the iris. Radiating rents and fissures are quite rare, and are not accompanied by any hemorrhage. The most frequent injury is a dialysis or separation of the peripheral portion from its attachment. This separation may be of almost any extent. It has been known to include so much of the membrane that it might be said to be entire, not enough of its ordinary support being left to retain any part of it in its normal position. The effect of a dialysis is usually to allow that part of the iris which is separated from its attachment to hang somewhat smoothly in the position of a chord to the arc which originally marked its place, so that both peripheral and pupillary margins are altered, as is seen in the accompanying cut, which is taken from Lawson.

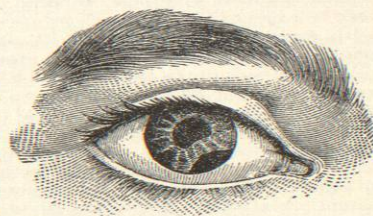


FIG. 2056.

The kidney-shaped pupil is quite characteristic. This injury is often attended with considerable hemorrhage into the anterior chamber, which is of no particular moment and rapidly undergoes absorption. Beyond keeping the patient quiet, little or no treatment is necessary. Active inflammation very seldom follows the injury, and the harm that results, apart from cosmetic effect, is principally optical, due to the presence of two pupils instead of one. The patient either suffers from monocular diplopia or from an indistinctness of sight, due to the entrance of light into the eye without passing through that part of the lens which is capable of forming a distinct image.

It has seldom been thought worth while to attempt any operative correction other than an iridectomy to remove any portion of the membrane which interferes with visual ability by hanging directly across the optical axis. An iridectomy should be performed only when time enough has elapsed after the accident to prevent any unusual tendency to inflammation.

Cuts and punctured wounds of the iris occur concomitantly with the injuries of the cornea or sclera, and require no special treatment other than what has already been mentioned in connection with those injuries.

LENS AND ZONULA.—The position occupied by the lens and zonula may be represented by a circle formed by the intersection of the walls of the globe with a plane which cuts the visual axis at right angles, a few millimetres behind the iris.



FIG. 2055.—Punctured Wound of Sclerotic Successfully Treated with a Fine Suture. (Lawson.)

A blow or pressure which causes the globe to depart momentarily from its approximately spherical shape, is likely to lengthen any one of the diameters of this circle and stretch or tear the zonula or the capsule containing the lens. And further, any pressure on the anterior part

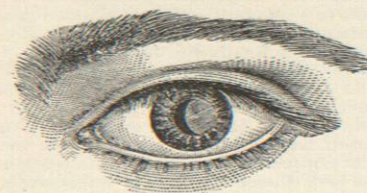


FIG. 2057.—Partial Dislocation of Lens which is Becoming Cloudy. (Lawson.)

of the globe which increases the tension of the walls of the anterior chamber is likely to throw the lens backward, because the larger area of the walls of the posterior chamber allows of a greater increase of capacity before the same tension is reached. A bulging backward of lens and zonula is therefore likely to follow, so that each and every diameter of the circle in which they lie is increased in length.

One of these two conditions has probably existed in most of those injuries in which the only organic disturbance is a partial or total dislocation of the lens, either with or without rupture of the capsule.

It is said also that a severe blow on the head will cause such shaking or oscillating of the comparatively heavy lens as to tear the delicate membrane which suspends it between the fluid and semi-fluid humors. It seems almost necessary to allow this if we wish to account for certain dislocations that are reported—those, for instance, in which the eye itself has not been touched by the body inflicting the blow.

The disturbance that takes place in all these cases varies greatly, from the slight displacement forward which indicates a mere stretching of the ligament, to an entire breaking away from its support on all sides, so that the lens is thrown back into the vitreous, and sinks eventually to the bottom of the eye, or so that it is forced forward entirely through the pupil and lies entirely in front of the iris. Occasionally the lens is pushed a part of the way through the pupil, or it is pushed so that it comes to lie a little to one side behind the iris, in which position its edge may be seen across the centre. Under these circumstances the fundus is visible clearly with a minus glass if the observer looks through that part of the lens which is in sight, or with a strong convex glass if he looks at it through that part of the pupil from which the lens has been removed. Whenever the edge of the lens is in sight, if brilliantly illuminated, it may be recognized by a thin meniscus of vividly contrasted light and dark, caused by refraction and total reflection at the edge where the front and back surfaces curve round to meet each other.

Where the suspensory ligament is torn, the lens, of course, is left free to assume the convexity natural to extreme accommodation. Hence one of the symptoms of subluxation is (in the emmetropic eye) apparent myopia with entire loss of accommodation, and amblyopia, which latter may be due in part to astigmatism. If the lens has been moved backward and to one side, so that it only partially covers the pupil, monocular diplopia may be present; and if it is entirely removed from its place, as when it has fallen back toward the bottom of the vitreous humor, an apparent hypermetropia of somewhere near eleven diopters will be found; and on looking at a reflection of the candle flame in the eye, only that image which is due to reflection from the corneal surface will be seen. The two fainter pictures which are reflected from the anterior and the posterior lens surfaces will, of course, be wanting. A tremulous iris calls attention to the fact that its pupillary border has been deprived of the support usually given it by the anterior surface of the lens; still this symptom is not pathognomonic.

Partial dislocations of the lens backward are likely to become complete in time, that body finally sinking down to the bottom of the posterior chamber, and remaining

there, after undergoing partial atrophy, for years—perhaps the least dangerous foreign body that can exist in that place. The eye is subject to the same inconveniences and accidents as were entailed by the old operation of couching.

In all posterior dislocations, unless there is some cogent reason for extracting, such as ciliary irritation or threatened sympathetic, it will be best to leave the lens as it is and make no attempt at removal. But if it presses forward on the iris, or has partly or wholly passed through the pupil and remains immediately behind the cornea, it should be removed as soon as the chemosis that immediately follows the accident has disappeared. The danger of attempting to remove a dislocated lens from the posterior chamber is very considerable. The cut is made of course as if for the operation for cataract, but the lens will rarely present itself on pressure, and recourse must be had to the spoon or the hook, and then, even when the utmost care is exercised, the lens will sometimes sink into the vitreous, where it cannot be recovered, or its extraction will be accomplished only with the loss of vitreous and perhaps subsequent accidents of hemorrhage and retinal separation.

If a dislocated lens is allowed to remain in the anterior chamber it gradually diminishes in size and sinks to the bottom of that cavity, where it remains in a shrunken opaque condition, and usually causes deterioration and opacity in the part of the cornea on which it rests.

When the lens is injured by a penetrating wound the cornea, or possibly the sclera, must of necessity have been punctured, and injury of the iris and ciliary body may also have taken place at the same time. Apart from the danger of these accompanying wounds, which of themselves may or may not be of a serious nature, there is every reason to expect serious trouble with the crystalline body. Any cut or puncture of the anterior capsule which brings the substance of the lens proper in contact with the aqueous humor is followed by an opacity and a swelling in that body, conditions which seriously interfere with nutritive and functional processes. Such an accident is much less serious in a child than in an adult, the softness and solubility of lens substance being such in the child as to admit of its somewhat rapid disintegration and absorption. These changes may take place so quickly and completely as to produce no serious injury other than the loss of the lens itself; or there may remain a capsular opacity which can be removed by any of the methods usually employed after the operation for cataract.

If much of the lens surface has been exposed by the opening of the capsule the swelling will be greater, there will be an increase of tension in the globe, and the pressure of the lens on the iris will cause a greater degree of irritation. If the patient has reached, or is nearing, adult life, the reaction caused by this disturbance will be quite severe, usually dangerous, and the result, so far as disappearance of the lens is concerned, will in no way be complete.

The closure of the capsular wound in such injuries is an impossibility. The indications are for temporizing and antiphlogistic treatment. Atropine should at once be given to prevent anterior synechiæ. Iritis and cyclitis should be combated with anodynes, and if the pain is severe, ice-cold applications should be added to the latter. Extraction should not be attempted unless the lens or a greater part of it has found its way into the anterior chamber. If the iris is pushed forward by the swollen lens and the symptoms are dangerously severe, the anterior chamber may be tapped repeatedly to allow the escape of aqueous and of any softened lens matter which has found its way into it; and in this way the process may be allowed to go on until sufficient absorption has taken place to permit the organ to return to its natural quiet.

After all inflammatory symptoms have subsided, if nothing but opaque capsule is left it may be operated on as before suggested; but if the rent in the capsule has been closed by a false membrane and there are considerable nucleous and cortical remains, these may be removed as in cataract operation, discission being the method which



promises the best results, especially in children. It is very important to delay such operations until all danger of inflammatory reaction has passed away. The processes above described will seldom be completed in less than two or three months, and during this time the patient should be kept constantly under the care of the surgeon, and during convalescence he should wear shaded glasses. In spite of every precaution many cases of injury to the lens are not likely to end happily either for the patient or for the surgeon. Capsular inflammation is likely to block up the pupil with a dense membrane to which the iris becomes strongly fastened; pus also may show itself in the anterior chamber; and, finally, there may be panophthalmitis with complete destruction of the affected eye.

**THE CHOROID.**—The choroid is often ruptured as a result of sudden compression. The rent may occur at a point so far forward as not to admit of diagnosis during life, and from such accidents no doubt come many of the cases of hemophthalmus posterior which make a fair recovery without any special mark to indicate the source of the hemorrhage. These anterior ruptures also are supposed to account for some of the hypothetical cases of commotio retinae. Though ruptures are sometimes seen at a point anterior to the *venae vorticosae*, most of those which fall under surgical observation are near the posterior pole of the eye. They do not come at a point directly opposite the blow or pressure which causes them, but are situated on the same side of a vertical plane which passes through the centre of the globe from front to back. This seems to be in accordance with *a priori* reasoning concerning ruptures. The choroid has been known to rupture in two places at once, both ruptures being situated in the same meridian and on the same side of the eye as the compression which caused them.

Very often the perception of light becomes quantitative as soon as the accident happens, but sometimes the diminution of vision is not very great until after several days have elapsed. However this may be, the power of accommodation is at once suspended, and after recovery vision rarely reaches its normal acuteness. The wound, when first examined, will be found—if there has been no very great hemorrhage—to be filled with blood which conceals its edges. The uninjured retinal vessels may sometimes be traced over the wound; at other times the retina is broken through and separated at its edges from the choroid. The indications for treatment are the same as in other ruptures of the external tunics, except that constant recumbency is not so imperative and the patient may be allowed a little more freedom after the first few days. The inflammatory disturbance that follows rupture of the choroid, though sometimes destructive, is not usually very severe, and the amount of useful vision that is recovered is dependent very much on the seat of the lesion. Of course, if the tear has extended through the macula there will be a permanent central scotoma. The size of the final scotoma is not always commensurate with that of the original injury, it being sometimes much less than would have been thought probable.

**FOREIGN BODIES.**—Concerning foreign bodies in general, that have entered the eye and remained in it, a word or two is necessary. The eye is never safe so long as they remain imprisoned in its tissues. Still there is hardly any place inside its walls where, according to reported cases, foreign bodies have not remained for months and years. But in all, or nearly all, the cases so reported serious trouble eventually developed and brought the patient to the oculist. Yet it is fair to suppose that patients have sometimes carried foreign bodies in their eyes to the grave without serious trouble, but this is so exceedingly rare that in general, when a foreign body has penetrated the globe, it is good surgery to remove it as soon as the diagnosis is made; and if it is not possible to remove it from the eye, then it should be removed with the eye.

This rule admits of one or two exceptional cases, to be mentioned hereafter—cases in which foreign bodies, on account of the slight inconvenience which they cause at the time, invite delay for the purpose of escaping for a

time the reaction which is sure to follow operative interference. Temporizing may be allowed only when the success of operative interference is not compromised by delay.

An investigation of the cases in which the globe of the eye has been penetrated by a foreign body and no attempt has been made to remove it, shows that in not a few instances the patient has experienced months of suffering and danger, and then finally has lost the sight of one eye, if not of both. Under these circumstances the surgeon should advise against a protracted postponement of operative interference. In a few cases only is it permissible to advocate delay. Thus, for example, if a patient presents himself having in the lens, or on the iris or retina, a small bit of copper or steel, an eyelash, or other substance which has been forced through to its position without exciting any lasting reaction, and if the eye has retained its usefulness in great measure, it is not necessary to attempt to remove it if it is so fastened in its position that any ordinary accident or change in the surrounding tissue is unlikely to make it at some future time more difficult of access. If it is so situated that to remove it is an easy and safe procedure, it would of course be the part of wisdom to do so without further delay. But if, as is often the case, it is where it can be reached only by operative interference attended with great risk of injury or failure, it is better to counsel delay, while giving the patient emphatic warning that when any change for the worse does occur operative interference will then become imperative. Ciliary injection, pain, tenderness, photophobia, or lachrymation, or any of the symptoms of beginning iridochoroiditis, should warn both surgeon and patient that further delay is dangerous.

**The Use of Magnets in Removing Foreign Bodies.**—Quite a large per cent. of the foreign bodies that penetrate the globe and would remain there but for surgical interference are made of iron or steel and may be removed more easily by the magnet than in any other way. Even if the magnet itself is not all-sufficient for this purpose, it may be of great assistance by adding magnetic attraction to the force applied by the surgeon to any steel instrument that he may employ.

For purposes of diagnosis the electro-magnet is especially useful. Definite sensations of pain in the eye as the circuit is made or broken furnish undoubted evidence of the presence of a magnetic metal. It must be added that the lack of such sensations does not with like certainty determine its absence.

There are three classes of magnets in use. The permanent magnet of Gruening is independent of batteries or electrical connections, and has proved to be a useful instrument. More powerful than this is the electro-magnet introduced by Hirschberg. Various forms of this are in use, most of them from five to eight inches in length and capable of developing an attractive force of considerable strength, even across the whole diameter of the eye. A giant form of this very valuable instrument has been constructed by Haab. This new instrument so enlarges its sphere of usefulness that it has become a well recognized part of the equipment of the hospital operating room. The fact that in its most desirable form it takes up a square metre of floor space, weighs nearly 200 kgm., and costs relatively a large sum, has somewhat interfered with its general adoption as an office accessory.

The methods of using the magnet are such as are naturally suggested by the situation. Various forms of tips are easily attached to the iron core; some being intended for insertion into the eye, others for placing on or near its surface. The greater the mass of the magnetic metal and the nearer the foreign body, the better. It should be remembered that although the attractive force is practically instantaneous in its action, the movement of the attracted body is not.

Viscosity and other structural conditions of the tissue are such that repeated attempts to extract a hypothetical foreign body on several successive days may give no evi-

dence of its existence, and yet, on a subsequent repetition of the attempt, the body in question will appear.

The presence of a foreign body in the eye is so serious a matter, and the immediate results of extraction by means of the magnet are so brilliant, that one may easily overestimate the average benefit to be expected. It is to be remembered that many of the cases in which a foreign body has been removed from the eye without infection or undue violence, turn out badly, ending in atrophy or other serious trouble. Notwithstanding all this the magnet is a very valuable addition to the surgical outfit.

Foreign bodies that find their way between the lids, and stick fast in the conjunctiva without deeply penetrating it, seldom give rise to any trouble after they are discovered. If they are not easily seen by evertting the lids under good illumination, it may be on account of their minute size, or because they have been carried up to the fold of transition beneath the upper lid. Particles of glass are particularly apt to escape observation. Focal illumination and a careful exploration with a Daviel spoon is all that is needed for their recovery, and this is easily managed unless there is considerable spasm of the orbicularis, when it may be necessary to anesthetize the eye with cocaine, or possibly, in children, to resort to general anesthesia. The seat of injury should be carefully examined to see that nothing has penetrated beyond the limit of the conjunctiva and has become lodged in the orbit or sclera.

Foreign bodies most frequently encountered in practice are those which have lodged in the substance of the cornea. They are sometimes very small and difficult to see, on account of their color being such as to harmonize with that of the pupil or iris. They can be detected readily in the direct light of the window, or by focal illumination, and can be removed nearly always without the aid of a magnifying glass. The point of a dissection needle, cataract knife, or any other sharp instrument will be found useful for the purpose. The patient should sit or stand before the window and fix the eye on some object which will insure its being held in the right position, while the surgeon stands wherever the substance can be most distinctly seen. Some patients will fix better by looking with both eyes, others with only the injured one.

It is not always possible to pick up a small particle of steel or emery on the point of a needle until after repeated efforts. In order to diminish the pain caused by such efforts it is a good plan to scrape off the epithelium from the very small surface (less than a millimetre in diameter) immediately surrounding the foreign body. When these small substances have penetrated deeply into the cornea, great care should be taken not to push them through into the anterior chamber. Such an accident is of a most serious nature; it is quite likely to necessitate an iridectomy for the removal of the foreign body. When the foreign body is so deeply situated that this accident seems imminent, it is best to enter the anterior chamber with a Graefe knife, which should be introduced at a point 2 or 3 mm. to one side of the foreign body and made to emerge at some distance beyond it. The flat of the knife will thus serve as a support for the foreign body, which may then be removed with safety by the usual manipulations. Care should be taken not to turn the knife so as to allow the escape of aqueous and not to encroach any more than is necessary on the pupillary area. Sometimes a splinter penetrates the layers of the cornea and seems to be placed lengthwise in its substance in such a manner that it can neither be removed by forceps nor grasped by a needle. In such a case, the upper layers of the cornea may be opened by a Graefe or a Beers knife, held with its back to the anterior chamber. In rare cases a small bit of foreign substance may be driven through the cornea in such a manner that one end of it hangs loose in the anterior chamber, while the other remains fast in the deeper layers of the cornea. When this state of affairs exists, the foreign substance may be removed by making a cut in another part and removing the offending substance from within with a pair of delicate forceps.

Foreign bodies in the anterior chamber, unattached to

the iris or lens, often sink to the lower part of the sclerotic border. Very small bodies may be concealed there or behind the iris or the opaque sclera. They sometimes become partly encapsulated or surrounded with lymph before exciting destructive inflammation. In some cases they may be removed by an iridectomy. Occasionally such a foreign body has ulcerated through and has been discharged before the eye was entirely ruined. If such a process is going on when the patient first presents himself, it may be well to temporize, but never to delay operating with the hope that the substance may be gotten rid of through the establishment of such a process.

In cases in which it is otherwise impossible to diagnose or localize a foreign body it may often be seen by the aid of an "x-ray" apparatus and a fluorescent screen. Two pictorial reproductions from different positions are usually necessary and sufficient to determine, with some degree of exactness, the position of the foreign body. This is done by comparing its position in the picture with that of other substances, which though outside of the eye have been placed in the field in a manner suitable for comparison.

Lens and iris seem particularly tolerant of foreign bodies. If a small foreign body is attached to the iris in such a manner that it does not seem likely to fall to the bottom of the anterior chamber, it may be left *in situ* as long as it causes no disturbance, provided the chance of successful removal is not growing less. A foreign body in the lens, if the opening in the capsule is small, may be left in place until it can be successfully removed by a cataract operation. If the capsule is widely opened, the case should be treated as a traumatic cataract, and the foreign body should be removed if possible with the swollen cortical.

A foreign body in the vitreous, immediately behind the lens, will sometimes present itself at the wound and be expelled by gentle pressure, or it may be removed by a scoop or hook, after the lens has been removed by a cataract operation. Such a result, though gratifying, is hardly to be depended on. In fact, the removal of a foreign body from anywhere in the vitreous is something of a forlorn hope. An incision either equatorial or meridional, may be made back of the ciliary region, and in such a manner as not to divide entirely any of the muscles. Through this opening the foreign body may come, or may be made to come. A few cases have been recorded, but no one has had so many, or has been so successful, as to warrant us in establishing any rule or definite course of action.

When a foreign substance has been in the eye so long as to cause considerable inflammation, which has rendered the vitreous opaque and full of connective-tissue opacities, removal is out of the question as a means of preserving sight, and a constant watch should be kept over the patient, so that the globe itself may be enucleated before the establishment of severe or dangerous inflammation. Small substances (less than 2 mm. in their longest diameter) that rest on the retina, or are suspended in the vitreous, do not demand surgical interference if, when they are first seen, the symptoms of irritation have passed away, and if delay in removing them does not seem likely to render the operation more difficult.

Foreign bodies, both large and small, may pass through the conjunctiva and remain in the orbit. If their presence is not recognized at the time, the external wound is quite likely to heal. In rare cases the body then becomes encysted, but more commonly it gives rise to orbital abscess, and is discharged or removed with the contents of the abscess. Orbital abscesses are not unattended with serious danger, on account of possible pressure on the globe or extension to the cerebral cavity.

William S. Dennett.

#### EYE, TUMORS OF.—I. TUMORS OF THE EYELIDS.

**A. Benign Tumors.**—The benign tumors of the lids are partly congenital, partly acquired later on in life. Their growth is but seldom accompanied by any inflammatory symptoms. These tumors, of course, during