A C L I N I C A L S T U D Y of 55 CASES

of INTRA-OCULAR RETENTION OF A FOREIGN BODY,

with special reference to the more RECENT METHODS

OF D I A G N O S I S AND T R E A T M E N T,

a n d t o

THE ACTUAL C O N D I T I O N OF THE E Y E S

T W O Y E A R S AFTER T R E A T M E N T.

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I shall endeavour in this communication, as the title suggests, to describe what appear to me to be, after a study of these cases, the most important points in the diagnosis and treatment of this class of eye-work. Thereafter I shall describe the individual cases very shortly, in so far as they have a bearing on the points previously mentioned, along with the actual condition of the eyes, the great majority of which were examined two years after the date of injury.

I think the latter has a most important bearing on the actual results and statistics of this sort. It is not enough to say that a piece of metal has been extracted from the eye by the electro-magnet, and that the eye was "saved".

It is more important to find out what is the visual acuity of the injured eye at least a year after treatment, and whether any subsequent complication has developed, such as detachment of the retina, or sympathetic ophthalmia.

In this connection I agree with Rogers[1.] who points out that we must be careful in accepting without reserve, statistics of favourable primary results in cases where a foreign body has been removed from the interior of the eye.

He mentions eleven cases with good primary results, which returned with secondary degenerative changes, and as he has seen several such cases from other cliniques, he supposes that other cases, which did not return, suffered in the same way.

The great bulk of this work was collected while I was House Surgeon at the Glasgow Eye Infirmary in the years 1911 and 1912.

At Glasgow, owing to the great ship-building industry on the Clyde, this variety of work constitutes the bulk of the eye injuries, and, as accidents of this sort fall to the lot of the House Surgeon to treat, I had thus an excellent opportunity of a clinical study of these cases.

With regard to the magnet operations, these, unless otherwise stated, were performed by myself, as also were several of the enucleations and traumatic cataracts, although many of the latter were performed by the surgeons of the Hospital, to whom I am indebted for allowing me to publish these cases.

A few of the cases were collected while I was Ophthalmic House Surgeon at the Oldham Royal Infirmary in 1912, and as assistant to the Ophthalmic Surgeon at the Blackburn and East Lancashire Infirmary in 1913.

I have omitted, in this series, all those cases where the foreign body in the eye has been a substance like glass - non-magnetic - and penetrated by the X-rays, but have adhered strictly to those cases where the foreign body has been composed of iron, steel, etc., to show the great importance of X-ray work, and of the electro-magnet in the diagnosis of these cases.

When we consider the number of eyes that are removed all over the country consequent on an

injury of this sort, it is astonishing to find that the majority of these workmen have no protection for their eyes, while following their occupation.

When one asks these men why they do not wear some sort of goggles, like the stone-breaker we see in the country lane, they will probably tell one that they are not allowed to wear any protect--ion, and on asking the managers of the various works why the men do not wear any protection, they will say that the men refuse to wear them.

Thus the matter stands.

DIAGNOSIS OF THE PRESENCE OF A FOREIGN BODY IN THE EYE

When examining a case of this kind, the following points should constantly be kept before one's mind :

(1) The history,

(2) Vision of the injured eye; also of the uninjured eye,

(3) Naked eye examination of the injured eye, aided by a convex lens with oblique focal illumination and a Coddington lens, if necessary.

This includes :

(1) Examination of the eyelids and surrounding parts,

(2) The cornea,

(3) the depth of the anterior chamber and contents of the anterior chamber, e.g., Hyphaema and Hypopyon,

(4) Shape of the pupil,

(5) Engagement of, or actual prolapse of, iris through the wound.

(6) Iris,

(7) Lens,

(8) Anterior part of the vitreous humour,

(9) The globe outside the cornea,

(4) The tension of the eye,

(5) Ophthalmoscopic appearances,

(6) X-ray diagnosis,

(7) Electro-magnet diagnosis.

(1) HISTORY :

One should listen carefully to the history. Obviously, a case which presents itself with a history of having been struck in the eye with scissors or a hat-pin, is not likely to have a foreign body lodged inside the eyeball, but where there is a history of something having struck the eye whilst the patient was working among iron or steel, we should go on the supposition that a foreign body is in the eye, and conduct our exam--ination in the methodical way which I am about to describe. In these days of the Workmen's Compensation Act, when a workman will occasionally tell you that a particular injury happened to his eye, and which he thinks is now responsible for his eye condition, and when, in many cases, the two conditions have no connection, we are apt to be somewhat sceptical when a man says he has been struck in the eye by a chip of metal, say a fortnight ago, and on examination we find no evidence of a corneal or scleral wound, and although the eye looks a bit injected, after a casual examination we find that

his vision is fairly good, and put it down to a case of ordinary conjunctivitis.

I think it is much safer to go systematically through the methods which I shall describe presently, even though one has only the faintest of suspicions of there being a foreign body in the interior of the eyeball. It pays better to do so in the long run, as possibly the case may come on for trial, and we find out, perhaps, that we have not done what we should have done as regards having made a thorough examination of the eye.

I shall here describe the main features of a case illustrative of this point :

Case 23. T.M. came to the Out-patient department of the Glasgow Eye Infirmary on January 8th 1912, with a history of having been struck in the left eye with a chip of iron rust whilst following his usual occupation as a boiler maker

A careful examination of the eye failed to show any sign of a recent wound or abrasion.

The lids were slightly oedematous, and signs of iridocyclitis were present in the form of a circum-corneal injection, a contracted pupil dilating irregularly under atropine, exudate in the pupillary area and one millimetre of hypopyon. The vision of this eye was reduced to hand movements. The vision of the other eye, which was in every way healthy, was $\frac{6}{6}$

The patient was admitted to the Hospital the same day. (At this time I was absent from my duties on holiday, but I came across the case at a subsequent period, and under circumstances which caused me to specially record it).

On admission to hospital, the magnet was applied and was entirely negative at all points.

As I shall point out later on with regard to X-ray diagnosis, I always advocate the taking of an X-ray plate before applying the magnet, and most certainly if there is any reason to suspect the presence of a foreign body in the eye and the magnet is applied right away and is negative, then a plate should be taken afterwards. No X-ray plate was taken in this case, and when the magnet operation was found to be negative, the case was looked upon as one of gonorrhoeal iridocyclitis, as the man acknowledged having had a recent gonorrhoea, some three weeks previously, and there was still some urethral discharge containing gonococci.

The man's story of having been struck in the eye by a chip of rust was disregarded, or thought to be a mere coincidence. Under local treatment and anti-gonococcic serum he improved somewhat.

Then his blood was examined and the Wasserman re-action found to be positive, and he received an intravenous injection of "606". He was dismissed after being a month under treatment, and then attended the out-patient department. While the man was attending the outpatient department he claimed compensation from his employers for the loss of the eye, and lost his case on the strength of the medical evidence that the case was one of gonorrhoeal, or syphilitic iridocyclitis.

Two and a half months after the injury (?) he was advised to have the eye enucleated owing to

recurrent iridocyclitis, the eye having practically no vision in it, and showing a tendency to soften

He was admitted as an in-patient for the second time when I came across him.

The day before the enucleation, I took an X-ray plate which showed quite distinctly a piece of metal, lodged in the outer part of the sclera.

I enucleated the eye, and, on hooking up the external rectus muscle, the hook grated against the foreign body, which was found to be firmly embedded in the sclera. It had evidently travelled through the eye in an oblique direction, from within outwards, causing sufficient damage to set up an acute iridocyclitis.

I record this case at length, not so much to point out the mistake of not having taken an X-ray plate in this case at the very first, (the mistake was quite legitimate, and, if the foreign body had not been lodged in the sclera, the magnet operation would in all probability have been positive), but as an example of the importance of not neglecting the patient's story, and to go about these metal cases in a methodical way.

Sometimes the patient will volunteer the statement that it was a large chip of metal which struck him in the eye, and that it fell down to the ground after it struck him. This, with perhaps the presence of a large penetrating wound of the eye-ball, would rather make one think of the eye being empty, so far as a foreign body is concerned.

Of course, one would not build a diagnosis on this, but, like all the other points which I am going to mention, it has simply to be kept in mind whilst carrying out the examination of the eye.

(2) LOSS OF VISION :

The vision of both eyes ought always to be taken when a case of this sort presents itself. In this connection, the visual acuity of the injured eye helps in the diagnosis of the presence of a foreign body, and subsequently in the prognosis and progress of the case. Again, the taking of the vision of the uninjured eye helps in the examination of the case perhaps where there is a case for compensation afterwards, and is also a help in the diagnosis of any sympathetic ophthalmia occurring later on.

The two common causes of failure of vision in cases of this sort are : A traumatic lens cataract and haemorrhage.

If the case is recent, hyphaema, from the vessels of the iris may obscure the vision, but the haemorrhage is usually one into the vitreous.

Of course I am well aware that there may be practically no loss of vision, especially if the foreign body is in the anterior chamber, or embedded in the iris, but no loss of vision is the exception. This is shown by a comparison of the cases with retention of a foreign body, and penetrating injuries where no foreign body was present

Compare first and second tabulated lists.

Any contraction of the visual field which
2.
Berry says is one of the most important points in the diagnosis of a foreign body in the vitreous, rendered difficult by the opacity of the lens, is not now of so much importance owing to the more recent methods of diagnosis by the magnet and X-rays, unless in some cases where the wound is scleral, when a detachment of the retina may be suspected, e.g., case 43.

(3) NAKED EYE EXAMINATION OF THE INJURED EYE :

One should carefully examine for the presence of a wound, and, having found a wound, determine whether it is penetrating or not. As a general rule the patient, after a recent injury of this sort does not complain of any pain in the eye.

I shall now take each of these parts, (the sub-headings of (3)) individually, and try to describe what I consider to be the most important features, the presence of which would cause one to to suspect the presence of a foreign body inside the eye-ball :

(1) Eyelids and surrounding tissues :

The most important point to be looked for here is the presence of a penetrating wound or abrasion either of the upper or lower eyelid.

The wounds of the eyelid are usually one of these two varieties :

(1) A small penetrating wound of the lid.

A penetrating wound of this sort indicates that the metal must have been travelling at a high velocity

to enable it to pierce a tough substance like the tarsal plate. If one finds an external wound of the lid, then he should examine carefully to see whether it penetrates or not. The wound on the other side, that is the conjunctival side, may appear at first sight to be a mere spot of ecchymosis, and the actual wound much smaller than the skin wound, owing to the conjunctiva closing quickly over it. When one finds a hole in the eyelid of this sort, and behind it, or near it, a penetrating wound of the globe, usually of the sclera, with escape of vitreous, a lowered tension and with loss of vision, a strong suspicion of a foreign body being present in the eye enters one's mind.

Scales with sharp edges usually produce this class of injury.

See cases 6, 24, 32, 37, 40 and 43.

(2) A vertically or obliquely split lid with a very much softened globe and a large penetrating wound of the eyeball behind, is indicative, usually, of the presence of a large scale in the eye, although in some of these cases the metal, after inflicting the injury, falls out again.

See cases No. 14 and 19.

One should also carefully examine the surrounding orbit, nose and cheek, as the foreign body may be lodged there, indicated sometimes by points of tenderness.

See case 3.

(2) The Cornea :

The wound may be in the cornea, or it may extend to the ciliary region.

I would specially mention one class of case which makes one suspicious, and that is where a small piece of metal has passed through the cornea and come to lodge in the posterior part of the eyeball, or in the orbit beyond.

The appearance is almost characteristic.

The corneal wound is, as a rule, linear, especially if the foreign body is a small scale

The fact that it is penetrating is shown by the presence of a greyish white line which looks like a scar in the posterior part of the cornea. This appearance is probably due to a break in the continuity of the Elastic Membrane of Descemet. The anterior chamber is, as a rule, full, or nearly so. The tension is but little if at all diminished.

See cases 16, 17, 20, 30, 31, 49 and 47.

If the centre of the cornea is pierced, a wound of the anterior capsule of the lens may be made out, also the tract of the foreign body as it passed through the lens to the parts beyond. If the corneal wound is not central then one may see a "rent" or "hole" in the iris which must not be mistaken for a pigment spot.

This variety of corneal wound is so small that it may be overlooked, but in a case of this sort the vision would probably have been affected, and if the case be gone about in a methodical way, the presence of the foreign

body is not likely to be missed.

(3) Depth of the anterior chamber :

This, because an empty or shallow anterior chamber is frequently met with in wounds of the cornea and ciliary region with no retention of a foreign body in the eye, as regards the diagnosis of the presence of a foreign body, is, in my opinion, of little value. As I have mentioned in the class of corneal wound above the anterior chamber is frequently full.

Hyphaema. In a recent case, blood may be present, but is frequently absent, as it soon becomes absorbed.

Hypopyon. This is only seen, as a rule, a few days after the injury, and, although indicative of mischief in the ciliary body, as regards the diagnosis of the presence of a foreign body, is of little or no value.

(4) Alteration in the shape of the pupil :

This, of course, is practically always present when there is a prolapse (the diagnos--tic value of which I shall speak presently).

It is when it is present with no prolapse that it becomes more important. It may be a bit irregular owing to a bit of metal in the posterior chamber catching on the free edge of the iris, and the metal is often seen.

I shall speak of the alteration in the shape of the pupil again, when considering the anterior capsule of the lens.

(5) Prolapse, or engagement of the iris in the wound :

While the iris may be engaged in the wound where the metal has entered through the corneal-scleral region, or even become actually prolapsed, in the pure corneal wounds caused by a penetrating foreign body, there is frequently no prolapse. In fact iris prolapse in pure corneal wounds I would consider to be rather against the presence of a foreign body. It is specially absent in those small penetrating corneal wounds with the foreign body at the back of the eyeball or beyond. In one case (case 22) a small spicule was actually entangled in the prolapsed iris.

(6) Examination of the iris :

This frequently throws some light on the subject. As I mentioned before in connection with corneal cases, a "hole" in the iris with a small corneal wound makes one very suspicious of the presence of a foreign body in the eyeball See cases 17, 29, 30, 31, 34, 40 and 49.

One must be careful not to mistake a pigment spot in the iris for a foreign body.

A little experiende is necessary in distinguishing between these two conditions, and in a few cases it is very difficult.

I have seen, on more than one occasion, a competent ophthalmic surgeon make a mistake between these three conditions ("hole", foreign body and pigment spot).

An examination of the iris of the uninjured eye helps considerably of course in the diagnosis, pigment spots being frequently present in both.

The iris may bulge forward at a point owing to the pressure of a foreign body behind it in the posterior chamber, or be retracted at a point (see case 2) owing to a foreign body having passed through it, and under atropine-dilation it is found that this point is bound down to the anterior ~~chamber~~ capsule of the lens.

(7) The lens.

One should examine for the presence or absence of cataract, and whether that cataract, if present, is more dense at a point.

Again, one should examine for the presence of a tract of a foreign body having passed through the lens. I shall speak of this more fully in connection with the ophthalmoscopic appearances.

(8) Anterior part of the vitreous humour :

In a case coming three or four days after injury frequently one sees the tell-tale yellow reflex indicative of pus in the vitreous and of plastic iridocyclitis.

(9) The globe - external to the corneal--scleral junction :

One can hardly miss the characteristic

penetrating wound with pouting edges and vitreous oozing out. A bit of metal may be seen to be sticking in the wound, or protrud--ing from it. One must be careful not to overlook a scleral wound which is partially healed.

(4) TENSION :

This is important in diagnosis, and also in prognosis. A greatly diminished tension from loss of vitreous usually shows a loss of vision at the time of the injury. Later on a sudden diminution in the tension with corresponding loss of vision indicates either a vitreous haemorrhage, or a detachment of the retina at the site of the original wound, usually.

(5) OPHTHALMOSCOPIC EXAMINATION OF THE INJURED EYE:

This, as a rule, does not afford much information in an eye which has been recently injured. In the first place, where the metal has caused a traumatic cataract, or, having passed through the lens or sclera, has become lodged in the posterior part of the eye, or in the orbit beyond, the media are, as a rule, very hazy, owing to the presence of opacity in the lens mentioned above, or to the presence of blood in the vitreous or anterior chamber. Again, in a recent injury of this sort, the eye is irritable to light, and, to say the least of it, the patient does not like the procedure. Still I think this examination should not be omitted, even in a recent

case, and especially in an older case where the media are more transparent if the lens has not been injured. In this examination I would pay particular attention to the following points :-

(1) The lens. Two points ought to be specially looked for here :

(a) In some cases, e.g., 9 and 15, one can actually see the foreign body lodged in the lens, but one must be careful not to mistake a small localized cataract for a foreign body. A common fallacy of this sort is where the foreign body, usually a blunt object like a tennis ball, or a non-penetrating pellet, striking the eye, (especially when seen some time after the injury), has caused a small opacity in the anterior capsule, which is really a healed wound at the point of rupture of the ant-erior capsule causing concussion- cataract often localized at a small point beyond in the substance of the lens.

(b) A point of rupture of the anterior capsule, with a distinct tract through the lens and a dense point in the substance of the lens may indicate the likelihood of a foreign body being lodged at the denser point. Again, a point of rupture in the posterior capsule at the end of the tract, may indicate similarly the foreign body being lodged in the posterior part of the eye, or beyond. This is specially seen in those small penetrating corneal wounds

where the metal is lodged at the back of the eyeball, or in the orbit beyond.

In the examination of the lens with the ophthalmoscope, I would draw attention to a condition which is liable to be mistaken for an exit wound (passing from the lens into the vitreous) in the posterior capsule of the lens.

This is a small localized exudate on the posterior capsule. This is often seen in cases a few days after injury, and especially if the injury has been caused by a blunt ~~edge~~ object such as a golf ball, or a tennis ball. It is due to the exudate in the vitreous, or on the posterior capsule of the lens from ciliary body irritation.

In conducting this ophthalmoscopic examination sterilized atropine, and cocaine in a recent case, ought to be put into the eye, but the examination should not bee too exhaustive, and should only occupy a few seconds

In any case, as I shall mention later, atropine should be instilled both with regard to further diagnosis and treatment by the electro-magnet.

In an older case where the eye is quiet, homatropine may be used, and a more prolonged examination may be made if the eye condition permits of it, and, the media being clearer as a rule, a more satisfactory examination can be carried out.

(2) The vitreous :

As mentioned before, in a recent case

the vitreous is full of blood clot, as a general rule, and one of these suddenly floating up in the line of vision, while using the ophthalmoscope, may cause the inexperienced to say that he sees the foreign body.

Although in a few cases, e.g., case 24, the metal can be made out, being recognised by its glistening aspect, I would also consider the following points as very probably indicative of a foreign body being in the eye :

(1) A "vitreous tract" :

This is sometimes seen, if the media are sufficiently clear, in wounds of the sclera where the foreign body has passed in an oblique or transverse direction through the eye. Starting at the wound of entrance, a definite tract may be made out passing through the vitreous. This appears to be dark to the ophthalmoscopic examination.

See cases 24, 28 and 32. At the end of this tract the foreign body may be noticed swinging about in the vitreous.

(2) Air bubbles :

These are liable to be mistaken for foreign bodies. Berry gives the differentiation of diagnosis between an air bubble and a foreign body in the vitreous. He points out that air

bubbles are frequently multiple, and have a clear centre with a dull margin; a piece of metal single, having a dull centre with a glistening margin. He says that if these points be attended to a mistake is not liable to be made.

I think it is important not to build a diagnosis on these facts, as the presence of air bubbles simply indicates that a penetrating wound of the eyeball is present, and, in each of the two cases (Case 17455) of this series where air bubbles were present, a piece of metal was also found to be present on subsequent examination by the X-rays and the magnet.

(3) The retina :

The general rule that ophthal--moscopic examination in a recent injury is of little value, except where the media are clear, applies to the retina as well. In an older case, or in a recent one where the media are suffic--iently clear, the two special points to be looked for are :

(1) Where the foreign body being lodged in the retina and sclera, is noticed by its glistening aspect, and by having a different focus from that of the retina (see case 2).

(2) Where there is a hole in the retina, the foreign body having

passed through the globe to the orbit beyond. It is well to make sure that the disturbance of pigment here met with, is not physiological.

In a recent case one sees a break in the continuity of the retina which is surrounded by blood extravasition. In an older case there is a definite gap surrounded by choroidal pigment, or there may be simply a large mass of pigment at the site of the original puncture.

Often it happens where one or several of the signs mentioned above are present, we can almost be sure that the foreign body is lodged in the eyeball, or at least has passed through it.

Although I have described at some length the ophthalmoscopic appearances in these cases, I would regard this part of the examination, which as a rule does not take more than five minutes, unless one waits for the dilation of the pupil, as merely preliminary to the more certain methods of diagnosis which I shall now describe. In a case of this sort, unless one finds, after a careful examination that it is unnecessary, the eye ought to be subjected to a routine examination as follows :-

First a preliminary examination of the eye, aided by the ophthalmoscope if possible; then the taking of an X-ray plate, followed by the electro-magnet. A second X-ray plate ought then to be taken, if the one preceding the magnet operation is positive and the magnet is negative, to confirm the first plate, or to see if there is any change

in the position of the foreign body. If this is done in such a methodical manner, I do not think there is any fear of the presence of a foreign body being missed.

I may be pardoned if I am too insistent on a careful scrutiny of these cases being carried out, but I do not do so without reason, as I am sure it is the experience of many ophthalmic surgeons not rarely to come across a patient who will say that he was subjected to a magnet operation at some other eye hospital, and was told that there was no foreign body in his eye, and when subsequent examination, aided it may be by an X-ray plate, or after examination of an enucleated eyeball, reveals the presence of a piece of metal in the interior of the eye.

(6) X-RAY DIAGNOSIS :

As most of my cases were metal cases, they afforded an excellent opportunity for X-ray work.

I think that an X-ray photograph should never be omitted even where one is certain of a foreign body being present, or on the contrary, where one is almost certain that there is no foreign body present, but where there is a doubt.

For many reasons, the taking of an X-ray plate before the examination and treatment by the electro-magnet is desirable.

In practically all my cases, with the exception of two at the commencement of the study, a plate was taken before the electro-magnet was used. The following are the more important

reasons for taking an X-ray plate before using the magnet :

First : The position of the foreign body can be made out with fair accuracy, even by the method which I shall describe, apart from the Mackenzie Davidson localization.

There is an advantage in knowing this, (see treatment by the Electro-magnet).

Second : The size of the metal can be made out with a fair degree of accuracy. If the metal is large, and the eyeball is badly damaged it is better to give a general anaesthetic and obtain permission for enucleation, if thought necessary, otherwise a lot of unnecessary pain to the patient is caused, and the probability of a second operation for enucleation of the eyeball is avoided.

Third : There may be more than one foreign body present.

I had one case (case 39) of this kind, when the electro-magnet was used right away owing to the X-ray apparatus not being in order, and a small scale of metal (5 x 2 mm) was extracted. As the eye was still irritable some weeks afterwards, an X-ray plate was taken, and a large foreign body localized behind the eyeball.

This case is a rare one, of course, but the mistake was a lesson, as the other eye developed sympathetic ophthalmia

Of course, if there is a piece of metal in the eye the sooner it is out the better, but the

taking of the X-ray plate as a rule did not take me more than five minutes. The patient was then sent up to the theatre, and while the sister was putting cocaine and atropine in the eye, preparing the patient, and getting the magnet fixed in position, the process of developing and fixing the plate was carried out.

In all the cases which I X-rayed, I only missed two foreign bodies. See case 11 where the plate was negative, but on naked eye inspection there was a suspicion of a small piece of metal in the iris, and the electro-magnet extracted a small spicule, ½ mm long; and case 22 where the plate was negative, and a small spicule 1 mm long was extracted from the prolapsed iris by the magnet. Of course, I had a few doubt--ful cases which were decided by the electro--magnet, or a second plate, if necessary.

I shall describe two methods of X-ray work which I used.

What an ophthalmic surgeon chiefly wants to know is whether the foreign body is extra-ocular or intra-ocular. In these days of the giant magnet, the exact locaility of the foreign-body in the eye in a recent injury is not so important as it was when only the small magnet was in use. I shall refer to this again under the treatment of these injuries.

First method :

4.

This is described by Boxer. He points out that probably in no part of the body is the rendering of the true value of

the relative position of parts more difficult than in dealing with the eye and orbit, because of the very overlapping of parts. From the nature of things, the radiograph must be taken through the head laterally, and, try as one will, one cannot avoid the perplexity produced by them.

Indeed it is only after looking constantly and daily at orbital radiographs that one can give a true rendering of things

The milliamperage passing through the tube and the time exposure are important.

The method which Boxer has recommended and which I have adopted in the majority of these cases is to use .5 to .6 m/a of current, and give an exposure of three minutes, leaving only nine inches between the face and the anticathode.

Of course, the thickness of the skull bones, and the hardness or softness of the tube will alter the procedure, but this current and time exposure are usually excellent in the majority of these cases.

The patient is seated on a chair with the plate enclosed in an ordinary half-plate photograph printing frame, and fixed to the head next the injured eye by elastic bands which are fixed on brass runners on the sides of the printing frame. A small diaphragm greatly sharpens the image.

To get the least overlapping of parts, it is best to advance the centre of the

anti-cathode half an inch in front of the malar of the uninjured side, so that the rays, so to speak, are looking somewhat into the injured orbit. This prevents the shadow of the near malar overlapping the shadow of the distant one, that is, the malar of the injured side.

There are two objections to this position :

(1) that the shadow of the foreign body is thereby projected further posteriorly than is actually the case, and

(2) theoretically, the correct position for the relative position of the plate to anticathode is that the former shall be at right angles to the central rays of the anticathode, but these two errors are allowed for in reading the plate, and if one always adopts this position there is little likelihood of error. To be certain that the relative position of the plate to anticathode is correct, one should look through the back of the tube through the diaphragm, and in doing so, the surgeon should look somewhat into the injured eye, depending on the height of the nasal bridge. An ordinary photographer's head clip fixes the patient's head securely. The patient is told to look fixedly straight forward at some object.

When there is a doubt after taking a plate by this method, or after the magnet has been used and found negative, whether the foreign body is in the eye or in the orbit,

another plate is taken, the first 1½ minutes of the exposure with the eye looking fully upwards, and the second 1½ minutes of the exposure with the eye looking fully down--wards. If the developed plate now shows two foreign bodies, it is in the eye if only one, then it is in the orbit.

A fallacy suggests itself here, that is, where the foreign body is in one of the ocular muscles, or in the capsule of Tenon, and it will have moved, but the extent of the movement is slight compared with the extreme deviation and depression of the eyeball.

After experimenting by this method by fixing metal points to the eye, and again by taking a skull and fixing an eye in position in the orbit, and placing chips of metal in different parts in the interior of the eyeball, one can become quite proficient, after some practice, at interpreting the developed plate, although I have not yet been able to say with certainty whether a foreign body is, if located in the anterior part of the eyeball, in the superior-external or superior--internal quadrant, or the inferior-external or inferior-internal quadrant, and similarly if it is in the posterior part of the eyeball, as Boxer suggests.

As I have mentioned previously, for all practical purposes, what s urgeon

wants to know is whether the foreign body is inside the eyeball or not, and if in the eyeball, its position, roughly, before applying the magnet. This method I have found fulfills these conditions satisfactorily. After a little practice it is easy to perform, and ten to fifteen minutes will complete the whole operation, including the developing and fixing of the negative.

Second method :

Mackenzie Davidson localization :

I have only used this in selected cases as it takes more time, and really requires a person experienced in X-ray work, to determine the position of the foreign body accurately - although, like everything else, I daresay one can become quite proficient with a little experience.

The method I adopted was that described by Maitland Ramsay.[5] For all practical purposes I would limit its use to the following classes of case :

First : Where the X-ray plate, as taken by the first method, suggests that the foreign body is embedded in the sclera, or is outside the eyeball, and where the electro-magnet gives a negative result.

Secondly : Where the case is not a recent one.

In this class of case it is well to localize the foreign body before proceeding to

use the magnet, because, if the giant magnet is used straight away, without having any definite idea of the position of the foreign body, the removal of the latter may cause considerable damage to the structures of the eye, owing to it having become firmly embedded in fibrous tissue. In a case of this sort, especially where the foreign body is in the vitreous, I think it is better to do a scleral section near to the position of the foreign body, and extract it, either by the small Hirschberg magnet, or the giant magnet, (see "Treatment by electro-magnet").

Another instrument which is used to determine the position of the foreign body in the eye is the Sideroscope. Of this instrument I have had no practical knowledge. The principle of the instrument is a small magnetic needle to which a small mirror is attached, and which records the movement of the needle on a graduated scale.

On bringing a patient's injured eye, with a piece of metal in it, near the needle, the movement of the needle is greatest when nearest the metal, and the greater the size of the metal, the greater will be the swing of the mirror. According to this, one is able to localize the foreign body, although I cannot see how it can be compared favourably with X-ray work, as regards accurate localization. Not having used this instrument, I cannot offer any criticism. It seems to be used more on the Continent than in this country.

TREATMENT :

Having now studied the case from its naked eye appearance, and verified our diagnosis by means of the X-ray plate, we proceed to treatment.

Obviously, the chief point is to get rid of the foreign body as soon as possible. A piece of metal when retained in the eye, especially in the vitreous, over 24 hours, generally sets up an inflammation in the eye very quickly as an irido--cyclitis either of the slow plastic type, or of the more acute and purulent variety, which is liable to end in the slow destruction of the eyeball with resultant Phthisis Bulbi or in panophthalmitis respectively.

Many cases have been recorded where the foreign body has been lodged in the eye, especially if in the lens, for many years, without giving rise to inflammation, but these cases are always to be considered dangerous as some day, apparently without explanation, the eye may suddenly develop an attack of acute inflammation.

Ramsay[6] cites two cases to illustrate this point. In one, the piece of metal, apparently, was in the ciliary region for 20 years without giving rise to any symptoms, and then suddenly an acute attack of inflammation commenced in the eye.

In the other, the metal was lodged in the lens for eleven months without any discomfort, and again the eye suddenly developed acute iridocyclitis at the end of that time.

Before undertaking treatment by the magnet in the usual recent case where we intend delivering the metal into the anterior chamber, sterilized

atropine ought to be instilled frequently into the eye so as to get the pupil as widely dilated as possible. Less pain is caused if the pupil is well dilated as the metal jumps against the iris, after perforating the zonule, as it is being brought forward, and, in these cases with dilated pupils, the foreign body is less liable to become entangled in the iris, and also there is less likelihood of an iridectomy being necessary.

We next come to the question whether the operation should be done under cocaine or general anæsthesia. Some of these patients suffer intense agony for some seconds when the metal hitches against the iris, or the ciliary body. One great advantage of doing the operation under cocaine is that the patient assists considerably in the extraction of the metal by the movements of his eyes, which he is told to make, and, granted a fairly sensible patient with well dilated pupil (I am speaking this time of the case where it is decided to draw the metal into the anterior chamber), I think it is better to do the operation under cocaine.

Another advantage of doing it under cocaine is from the point of view of diagnosis, that is the question of any pain being experienced as the metal travels forwards towards the magnet point. As a general rule there is a distinct pain in the eye, but in one case (case 20) the small scale of metal appeared in the anterior chamber after travelling round the edge of the lens without any pain being experienced, and, unless the

metal had been shown in the X-ray plate, it could quite easily have been missed owing to its small size (2 x 1 mm), if the anterior chamber had not been carefully watched.

Under general anaesthesia an anaesthist is needed, of course, and usually another assistant to pull down and direct the movement of the eye--ball according to the difficulties which may arise

Speaking generally, I would restrict the use of chloroform to the following class of cases :

(1) Where the patient is very nervous, and where any sudden movement on his part, when the point of the magnet is in the anterior chamber or vitreous, might result in traumatic cataract and loss of vitreous respectively.

(2) Where the foreign body is suspected to be non-magnetic from the history, e.g. gun--shot wounds, and where it may be necessary to enucleate the eye if the foreign body cannot be removed.

(3) Where, as I mentioned before, the X--ray plate shows the presence of a large piece of metal and the condition of the eyeball suggests the possibility of enucleation.

(See cases 4, 5 and 14) In this class of case, I think it is better to obtain permission for enucleation, if necessary, and conduct the magnet operation under chloroform rather than subject the patient to considerable pain during the removal of the metal.

This brings us to the different kinds of magnets which are used. I have had experience of three varieties :

(1) The vertical, or suspended magnet,
Ramsay[7]'s modification was used at the Glasgow Eye Infirmary,

(2) Haab's stationary horizontal giant magnet,
This was used at the Oldham Royal Infirmary

(3) The Hirschberg hand magnet,

I do not intend to go on to describe these different magnets, as they are sufficiently well described in the text-books. I intend more to criticise the two varieties of giant magnets mentioned above, and also to consider the use of the hand magnet.

Another variety of magnet is the ring magnet

The advantage claimed for this variety is that the lines of force are parallel and do not radiate as in the other magnets. This is really a disadvantage as Butler[7a] has pointed out, as it will not attract a piece of iron which lies in the lower part of the globe, because the field of the magnet is confined to a small plane at right angles to the plane of the ring. To get this attractive force the eye must be placed so that the line joining the anterior chamber and the foreign body is horizontal, a rather difficult position. Besides, the ring magnet entails the patient sitting up, and this has all the disadvantages, which I shall describe presently, of the sitting posture in an operation of this sort.

It is well to have both a giant and a small magnet. Each has its different uses, as I shall presently describe. Some authorities condemn the giant magnet, because they say it may cause considerable damage to the eye. If used in a proper manner, which can only be obtained by experience, and in the proper class of case, I think it is a very serviceable instrument.

Of the two giant magnets mentioned above I prefer the suspended one. Of the methods of suspension I prefer the kind described by Ramsay, where the magnet is suspended from a strong wire from the ceiling. At the other end of the wire is a suitable weight so adjusted as to render the manipulation of the magnet easy, and without exertion.

Another method of suspension is to have a many-jointed bracket jutting out from behind the surgeon's back. I do not think this method of fixation is as good as the one mentioned above, as the magnet point cannot be manipulated so rapidly and easily to meet the difficulties which may arise, as is the case with the wire method of suspension.

After a little practice it can be manipulated with great dexterity and precision.

The fears that the admirers of the Haab magnet have that the wire of the suspended magnet will break has not been realised in my experience

That at the Glasgow Eye Infirmary has stood for years, and undergoes periodical testing without showing any defect.

One outstanding advantage which this magnet has over the Haab magnet is that the patient is lying on the operating table, so that any further procedure to be done to the eye, such as iridectomy, douching of the eye, limbal section, etc., when the metal is being drawn into the anterior chamber, can be carried on without moving the patient. When using the Haab, on the other hand, the patient is seated on a chair, and requires to be transferred to the table if anything further, such as before mentioned, requires to be done.

Again, in the suspended magnet, it is the magnet which is moved, assisted by telling the patient to look in a certain direction to direct the path of the metal forward. With the Haab the operator manipulates the patient's head

The movements of the suspended magnet for the same purpose can be more carefully controlled, although at first this magnet in one's hands seems a clumsy instrument.

Again the patient has pain in the eye as the metal passes forwards, and when the Haab magnet is being used he naturally draws back the head, and so may complicate matters. In this sitting posture too, the patient sometimes faints

I would here cite the authority of
8.
Rollet, who says that it is best to have the patient lying down, and the magnet fixed vertically.

Again, operating with the Haab magnet, the surgeon manipulates the current by a footrest

With the suspended magnet, on the other hand, this is left to a capable nurse who manages the rheostat, and, at the words "One", "Two" and "Three" from the surgeon, switches on weak, medium or strong current, or "Off", as the case requires.

The surgeon has thus full attention given to the eye, and at the words mentioned has the desired effect produced without having to move his foot and hold the patient's head at the same time, not to mention his observation of the patient's eye.

One ought to have at least five points for the giant magnet :

(1) A large round point, shaped like the closed end of a large thimble. This is usually applied first, and over the cornea, as it has the greatest attractive power of the five, and is very useful in drawing small pieces of metal from the vitreous through the zonule into the anterior chamber. After this has been done, it should be laid aside, and one of the others, or the hand magnet, used, to suit the individual requirements of the case.

(2) and (3) long, narrow, blunt, and long, narrow, sharp points. These are not round in the long axis, but flattened, so as to enable them to be inserted more readily and easily, into a scleral wound without causing loss of vitreous. These points are useful for inserting into the vitreous after a

scleral puncture, especially where the foreign body has been accurately localized; being narrow, they cause little damage.

In one case (case 2), a scleral puncture was done on two unsuccessful occasions to try to extract a spicule which was embedded in the back of the eye, and projected forwards through the retina into the vitreous. No detachment of the retina resulted, and the eye retained a vision of $\frac{6}{36}$, the diminution of vision being due to a localized cataract which was caused by the original injury.
(4) and (5), angled-blunt, and angled-sharp points. These are useful in extracting pieces of metal from the anterior chamber with a weak current, although their use may be supplanted by the hand magnet. They are also useful for insertion into the ciliary region, (see case 28).

With these remarks I shall now pass on to the different procedures which I have adopted in the different classes of cases, the difficulties which may arise, and how to deal with these.

Non-magnetic instruments, of course, must be used throughout the operation which is preceded by a perchloride-mercury douch, 1/2000. Careful sterilization, and the avoidance of contamination of the magnet points are important and rigid asepsis throughout. The usual technique preceding an eye operation is performed, seeing especially to the height of the table to suit the individual case.

First : Where the metal was in the anterior chamber, embedded in the iris, or behind the iris, where the wound was corneal, or corneal--scleral.

The method adopted in this class of case was to try if possible to extract the metal through the original wound by introducing the point of the hand magnet into the anterior chamber. I think it is quite legitimate practice to enlarge the corneal wound slightly in a direction away from the centre of the cornea, if one thinks that by so doing, the metal can be extracted in a case where it was found impossible to draw the metal through the original wound: otherwise, unless the anterior chamber was empty, a limbal section with a Graefe knife was made at a point near the position of the metal, and the point of the hand magnet introduced and the metal extracted.

If the anterior chamber is empty I think no harm can result by waiting some hours to allow the anterior chamber to re-form, when a section can be made without risk of damage to the lens, and with less likelihood of haemorrhage from the iris. If one sees the foreign body embedded in the iris, or even lying loose in the anterior chamber, I do not think it is good practice to try to seize it with forceps, as the first attempt is often a failure, and troublesome haemorrhage postponing the operation, with injury to the lens capsule may result. Magnetic force is much more satisfactory, that is if the foreign body is

magnetic, as less damage is likely to result, less pain is caused, and the method is more certain than trying to catch it with forceps.

In some cases the metal was removed without interfering with the iris, but in others, prolapsed iris required to be excised.

If the corneal wound is at all large, it should be covered by conjunctiva. The best way to do this is to incise and under-cut the conjunctiva all round the limbus, and by means of a catgut purse-string suture, draw it completely over the cornea. After a few days the catgut is absorbed and the flap slips back in position, leaving a healed corneal wound. This method helps to heal the corneal wound more rapidly, and is an excellent precaution against sepsis.

I have had no experience of the corneal suture as recommended by Maddox.[8a.]

Second : Where the wound was corneal, or corneal-scleral, and the metal embedded in the lens.

Here the giant magnet with number 1 point was applied over the centre of the cornea, to try to draw the metal into the anterior chamber

If this was successful, then a sharp point of the small magnet, or of the giant magnet, with reduced current was introduced through the original wound, if large enough, or otherwise through a limbal incision, and the foreign body extracted. The cataract was dealt with later.

If the metal did not move from the lens

after repeated attempts by the giant magnet, or even after actual application of a sharp point to the lens, then, unless there were symptoms necessitating the immediate removal of the lens matter, the case was left alone for a few days, when the magnet was again applied in the hope that, the lens matter having become more swelled, the foreign body would be less firmly embedded.

If this was again unsuccessful, then the case was left until the lens matter required to be drawn off. Sometimes when the incision was made for the drawing off of the lens matter, the foreign body escaped along with the gush of lens matter. If it did not do so, then the sharp point of the magnet was introduced through the incision, and the foreign body extracted.

See case 1.

I do not intend to criticise the different methods for removal of soft lens matter in these cases. When the metal was removed at the first attempt, and when it came to the extraction of the lens matter later, a small lateral corneal puncture with a Graefe knife was made, and the lens matter removed by Teale's suction tube, otherwise a keratome incision was employed.

Third : Where the metal was resting in the vitreous chamber.

(A) Where there was a <u>recent</u> wound in the <u>sclera</u> or in the <u>ciliary</u> region.

In every case an attempt ought to be made to draw the metal into the anterior chamber, and extract by that route after a limbal section.

There are several reasons for adopting this route :

First : Where the wound is in the ciliary region. If the metal is extracted by the original wound route, further damage to the cliary region is caused, and considerable haemorrhage may result. In some cases the metal "locked" in the wound, and necessitated enlargment of the latter

Second : Where the wound is in the sclera :

Extraction by this route sometimes entails more loss of vitreous, a serious thing in itself, besides, any tag of vitreous hanging out of the wound is an excellent culture medium for micro--organisms.

Again, like the wound in the ciliary region the metal often "locked" in the wound, and necessitated its enlargment. Further damage to the scleral wound renders the possibility of subsequent detachment of the retina more liable to happen.

Although, as I have mentioned before, an attempt ought always to be made to draw the metal into the anterior chamber, in these cases, by the giant magnet, yet in many cases it is exceedingly difficult, in fact impossible. This is particularly the case where a large scale is present, or a scale with ragged edges. In many of these cases, instead of sliding round the edge

of the lens and perforating the zonule "edge first", they engage "broadside on", if I may use the expression, and actually become "locked" and firmly fixed in the circum lental space, an even more serious position than the first.

If it is found that the anterior chamber route cannot be adopted, then of course, the metal must be extracted through the original wound.

Before drawing a piece of metal by this route, it is well to dissect up the conjunctiva all round the wound, so as to cover the wound completely after the metal has been extracted.

As I mentioned above, sometimes the metal "locks" in the wound by engaging "broadside on". In a case of this sort, one of the long narrow magnet points was inserted just inside the wound, and no more, and the metal engaged on it by turning on a weak current. Then a flat, non-magnetic spatula, was passed along the magnet point to push the scale on to the point of the magnet, so as to make it lie with the edge in the axis of the wound, when extraction was easy.

I have found this manoeuvre useful, and it often prevents the requirement of an enlargement of the wound with a chance of more vitreous being lost.

I have not tried the method recommended by Lamb[9] of Cincinatti, who disapproves of Haab's method of removing foreign bodies from the eye by a large stationary magnet, because the practice of bringing the patient to the magnet is unnatural

and awkward, and the drawing of the metal into the anterior chamber as causing injury to the ciliary body and lens. If the scleral wound is small, or the wound is corneal, he makes an meridional scleral incision about 6 mm long, and commencing 10 mm behind the limbus, under a conjunctival flap.

The small magnet was then used. The rationale of this procedure is that the part of the sclera in question is suitable for operative interference because it is behind the ciliary body and in front of the ora ~~serrata~~ Serrata: it is not concerned with vision: it does not contain any important vessel or nerve, and finally, it heals well. I think these reasons are excellent in theory, but I do not see the necessity of inflict--ing further damage to the eyeball, and again, an incision of 6 mm long would not be large enough in cases of large scales in the vitreous to allow of easy extraction.

It is important before covering the wound with conjunctiva to carefully excise any prolapse of vitreous or choroid. A prolapse of vitreous is liable to overlooked, and its appearance, like a shred of mucus adhering to the wound, while carry--ing out the subsequent dressing of the eyeball, is liable to be mistaken for such (mucus) by the inexperienced.

With regard to the covering of the wound with conjunctiva. The cutting away of the conjunctival flap on one side of the wound, and the under-mining and sliding of the other over the

wound is important, so that the line of conjunctiva suture is well away from the scleral wound.

Stitching of the scleral wound is bad practice owing to the tough nature of the tissue where to and fro movements accelerate the danger of detachment of the retina, and cause more haemorrhage and quite unnecessary if the scleral wound is well covered with conjunctiva.

(B) Where the wound was recent and corneal, and the foreign body resting in the vitreous.

It was in these cases that the giant magnet was most useful. By carefully manipulating the magnet, it was possible in many cases, to draw the metal through the circum lental space, perforating the zonule, into the anterior chamber, or even through the lens, if that had been already injured. As a rule the lens was rarely injured in this attempt, and if it was found to be cataract-ous, that fact was noted before the magnet was applied. The large blunt point of the giant magnet was inserted over the centre of the cornea in the first instance, and a weak, medium or strong current used according to the effect first produced by the weak current. In some cases the metal shot right into the anterior chamber, the patient experiencing a sharp pain. I have previously mentioned a case where no pain was experienced, and unless the X-ray plate had demonstrated the presence of a chip of metal in the vitreous its presence in the anterior chamber, after application of the magnet, might have been missed, owing to its small size.

If there was no result after the application of the strong current, two or three sudden makes and breaks of the current occasionally brought the metal forward. As soon as the iris began to bulge, the direction of the magnetic force was altered, so as to try to draw the metal under the iris into the anterior chamber. In some cases where the metal had sharp edges it did not move any further until a limbal section was made over the spot and an iridectomy done, when it was easily extracted by the hand magnet.

The usual toilet of an eye wound should be carefully attended to after extraction of the metal; all prolapsed iris being excised, and the edges of the section wound being carefully freed from the iris as one does after an ordinary cataract extraction.

In drawing the metal forward by this route it may become fixed in the ciliary region, from which it may often be very difficult to dislodge. In case 28, for example, the foreign body came forward and became fixed in the ciliary region, and it was only on the third attempt, after a limbal section, with an iridectomy above, and the sharp angled point of the magnet introduced into the ciliary region at the site of the foreign body, that the metal, a scale $\frac{1}{2} \times \frac{1}{2}$ mm, was extracted. The eye did well, and the resultant vision was $\frac{6}{24}$.

10.

Hirschberg considers that the most difficult magnet cases are those where the foreign bodies become lodged in the ciliary region. Even the most powerful magnet will have very little power

as the resistence offeredby the fibres in this region will be very great. He describes a case where repeated attempts by the giant magnet were unsuccessful in drawing the metal, which had been lodged in the ciliary region, into the anterior chamber. As the lens was cataractous, he did a limbal section, then an iridectomy at the site, and introduced the point of the magnet through the zonule, and the operation was successful. My own case was similar, but no cataract was present, or subsequently developed.

Another method adopted by some surgeons in this variety of case is to do a scleratomy either near the foreign body, if it has been localized, or between the external and inferior rectus muscles far back, if the foreign body has not been localized, and to insert the magnet point into the vitreous.

In a recent case I think this route should be avoided for the following reasons :

First : The risk of subsequent detachment of the retina at the site of the scleral wound.

Haab[11] says that a scleral incision in these cases is highly undesirable, as it leads to detached retina. Although no detachment followed where a scleral incision was made to remove the foreigh body in my own series of cases, yet two cases of retinal detachment occurred under the scar of the original scleral wound caused by the entering metal.

Second : The risk of any prolapse of vitreous however small, during the manipulation of the magnet is important, not so much because of the actual loss, but because the vitreous humour is an excellent

culture medium for micro-organisms.

I would restrict the use of sclerotomy in these cases of corneal wound with the foreign body in the vitreous to the following conditions :

(1) Where signs of anterior uveatis have already developed. To draw a piece of metal into the anterior chamber under these conditions is to open up fresh paths of infection. A scleral puncture after localization was done, therefore, in case 42.

(2) Where the foreign body is in the vitreous, or sticking in the sclera at the back of the eyeball, and where external application of the magnet produces no result. See cases 2, 41 and 44.

(3) Where the foreign body has been in the vitreous several days. In a case like this the foreign body becomes fixed by organised exudate around it, and, not only is it more difficult to move by external application of the magnet over the cornea, but also the dragging of the metal, if it does move forwards, produces considerable damage to the interior of the eyeball owing to its fixation in the tissues. In these cases it is better to localise the foreign body in the vitreous, and do a scleral puncture near the site, and insert a sharp point of the hand magnet, or of the giant magnet, with reduced current, into the wound. See case 42.

Fourth : Where the foreign body was noticed by the ophthalmoscope to be embedded in the retina and sclera at any part of the globe.

The external application of the magnet was first tried to draw the metal into the anterior chamber. If this was not successful, then a

scleral puncture near the site of the foreign body with insertion of the sharp point of the magnet was done. This procedure was carried out in case 2, but was unsuccessful, although the vision remained good, and no subsequent inflammation or detachment of the retina, developed.

Fifth : Where the metal was suspected to be, or had actually been localized, behind the globe in the orbit.

External application of the giant magnet in these cases is of no use, as a rule. In many cases no pain was experienced, in others, an indefinite, dull, dragging pain was felt by the patient. In a case of this sort, the actual condition of the eye itself is of more importance than in trying to explore the orbit for a foreign body, whereit does little harm, as a rule. For example, in case 54, signs of commencing panophthalmitis necessitated instant removal of the eyeball within 24 hours of the injury, and the foreign body, which was left embedded in the outer and posterior part of the orbit far back, caused no trouble subsequently.

Although I have described in a general way the different methods which were adopted in different classes of cases, still one cannot lay down definite rules for individual cases, because, as difficulties may arise which prevent the carrying out of the plan which one had originally intended, another method may require to be adopted.

I again insist on the most careful technique being adopted as regards asepsis, the careful covering of the corneal, ciliary and scleral wounds

with conjunctiva, and the excision of all prolapsed iris and vitreous.

In those cases where the eyelid has been split, the stitching of the gap is rather important.

A suture was first inserted at the free margin of the lid, and this was not tied, but held taut by a nurse while the anterior and posterior sutures were being inserted, the first suture being tied last of all

By so doing the sutures can be put in correct apposition so that the small but very noticeable indentation of the lid margin, so liable to follow the healing of a wound of this sort, was pradtially avoided

AFTER-TREATMENT OF THESE CASES :

I would consider the after-treatment of these cases under two periods, because I have noticed that, when we have to consider the question of enucleation of the eyeball, it generally happens during one of these periods, or after the second period.

The first period :

Under this head, which includes the first three or four days after the accident, I would place the following class of cases as requiring enucleation :

(1) As I have mentioned previously, ahopelessly damaged eyeball should be removed straight away, and if there is a doubt whether removal is necessary or not, the patient's consent having been first obtained, the magnet should be applied under chloroform, and after the metal is extracted, it may be a question whether the eye should be removed at the same time, or whether one should wait a few days to give the eye a

chance. In the latter case, a very few days will decide the issue, and one should adhere to the general principle that enucleation should be done in this connection if the eye has little or no vision.

(2) Where there is threatening panophthalmitis.

As I shall mention later, the eyeball is not often destroyed by this variety of inflammation after removal of the foreign body. The usual way is by a slow iridocyclitis. If, on going to dress the eye one morning soon after the magnet operation, there is more than the usual amount of chemosis of the conjunctiva, with perhaps exudate in the lips of the wound and a hazy anterior chamber, then I think it is better to remove the eyeball at once. If it is done at this stage, I do not think there is much likelihood of meningitis developing. In my two cases of this kind (24 and 54), a healthy socket was obtained by early removal of the eye; a longer convalescence and recurrent ~~less~~ pain are avoided. Of course, if the eye is seen at a later stage with pus in the anterior chamber and swollen eyelids, it is better to incise the eyeball and wait until the panophthalmitis has subsided when the resultant Phthisis Bulbi can be removed. This was done in case 8.

Of course, opinions differ with regard to the question of enucleation in panophthalmitis. From my limited experience I can only say that, provided enucleation was done at an early stage, no harm resulted.

If it has been decided to incise the eyeball and allow the inflammation to quieten down absolutely

before enucleation, I think the said enucleation should not be delayed over a month in view of a case which I saw last yearat the Glasgow Eye Infirmary. This was a patient who had had a piece of metal removed by the magnet. The eye went on to panophthalmitis, and the resultant stump was not removed until two months after the original injury. Sympathetic ophthalmia of a severe type developed in the second eye, and left the eye with a vision of $\frac{4}{60}$. This case is interesting as it is a well know fact that sympathetic ophthalmia following panophthalmitis is rare, in fact some authorities state that it never occurs.

Second period :

With regard to the care of the patient after leaving the operating table I do not intend to say much, because here the same measures are adopted as after any other eye operation.

Dressing of the eye morning and evening, or oftener if necessary, beginning 12 hours after the operation, with douching of the conjunctival sack and instillation of atropine are carried out. For the relief of pain, which is usually due to an iridocyclitis, various measures can be used - hot fomentations, dry heat, leeching, drugs in the shape of aspirin, calomel and opium pill, etc, with rest in bed and regulation of the bowels are the more important measures.

Sub-conjunctival injections of perchloride or bicyonide of mercury, (1 in 3000 or 4000 twice weekly), 1 c.c at a time, are useful in these

conditions of iridocyclitis. Solutions of sodium chloride in increasing strengths, beginning at 2 per cent, have the same effect. What I would point out is that the advisability of the continuance of these, and of other conservative measures will depend on the condition of the eye at the end of say three weeks, and here we come to the most important question with regard to the after-treatment of these conditions, viz.- the question of enucleation in the event of the eye not making any definite progress towards recovery at the end of that time.

Of course, each case must be considered on its own merits, but in the course of my study of these cases, I have observed certain pathological appearances in these eyes, from which a foreign body has been removed, which should cause one to advise enucleation at an early date. I am now speaking of the condition of the eye from the second or third day until the end of the third or fourth week, speaking generally.

The following are the special clinical features to be looked for :

(1) A muddy, injected iris, with perhaps exudate in the pupillary area, with, may be, the presence of hypopyon. I have found that keratitis punctata is rather remarkably conspicuous by its absence following a recent injury of this sort. It is more likely to be present at a later stage of the inflammation. These features indicate the presence of a plastic iridocyclitis, and I would

advise enucleation with this condition of affairs present, because this class of case, like 2 and 3, more likely to end in a soft eyeball and phthisis bulbi than go on to panophthalmitis, is especially liable to be followed by sympathetic ophthalmia.

(2) By oblique illumination with a strong convex lens, a definite yellow reflex is noticed in the vitreous. This is usually accompanied by the foregoing signs of iridocyclitis, and indicates a plastic or suppurative uveatis, as shown by the exudate in the vitreous. This I have found frequently follows those cases where a "vitreous tract" is present at the commencement, and also in those small punctured corneal wounds where the foreign body is lodged in the back of the eyeball.

This again, like (1) will most likely end in a sightless soft eye, and ultimately in phthisis bulbi, with a risk of sympathetic ophthalmia.

(3) This type is perhaps seen at a later stage than (1) and (2). An eye which at first sight looks to be improving, but on closer inspection the iris looks somewhat atrophic, the vision being practically nil, and, on feeling the tension, which tends to be below normal, the patient jumps when pressure is made on the ciliary region. In these cases the patients often have sharp attacks of pain in and around the eye, especially at night,

In all these three types of pathological eyes, I would advise early enucleation, chiefly because of the risk of sympathetic mischief if the eye is left in, and later, if sympathetic ophthalmia

does not follow, the eye becomes useless, as far as vision is concerned, and lateron will probably end in a shrunken eyeball, liable at times to attacks of pain and inflammation, besides being an unsightly organ. In a workman who is earning his daily bread by the use of his eyes, and where the aesthetic effect of an artificial eye does not matter so much, it is criminal to dally with an injured eye of this sort, and anyone who has seen a severe case of sympathetic ophthalmia, with its consequent results, will not hesitate for a moment to advise enucleation with this condition of affairs present.

I have no doubt that many of these eyes were sacrificed where, if they had been retained, perhaps they would have quietened down in a few months, and given rise to no further trouble, but with the risk of sympathetic in the back-ground I do not think that one should have any further scruples on that point. Of course, if we had any certain guide to let us know whether sympathetic would develop or not, then the circumstances would be somewhat different. I shall speak later on of the recent work on the pathology of sympathetic ophthalmia which throws, at least, some further light on that obscure disease, but, until we have something more definite to go on, I think the only attitude to be adopted is that which I have mentioned above.

This brings us to the procedure of removal of the eye in these cases. In every case of removal, enucleation of the globe was done.

I think that, following a penetrating wound, enucleation should always be done, owing to the few recorded cases of sympathetic ophthalmia following eviseration. If the surgeon desires to implant a glass globe to secure a more moveable stump, then I do not see any objection to the method of implanting the globe in the Capsule of Tenon or paraffin, as recommended by Ramsay[12.]: catching up the muscles by ~~the~~ a suture before cutting them, and tying the muscles and conjunctiva over the globe after insertion.

AFTER THE THIRD PERIOD :

Between these clinical types, which I have mentioned above as indications for enucleation and those which have given no anxiety from the first, the latter usually being those where the foreign body has been lodged in the anterior part of the eye ball, are cases which must be dealt with according to the individual circumstances: always remembering that other things being equal, if the eye has useful vision - by useful vision I mean an eye which is not reduced to counting fingers, but which can make out objects at the other side of the room - an effort ought to be made to preserve it.

It is in this connection that sub-conjunct-ival injections of Bicyonide of mercury, plus the usual local treatment, are useful, often apparently leading to rapid improvement of the eye. In the carrying out and continuation of this treatment I would pay special attention to the following points :

Ciliary injection and tenderness, pain, appearance of the iris and vitreous, tension and vision of the eye.

If these are not satisfactory in a doubtful case after five or six weeks from the date of injury, then the question of the removal of the eye has got to be considered.

13.

I would here quote Hepburn, who says, "a well balanced judgment in dealing with all cases of injury, in order to avoid excision of the eye, is as hard to acquire, in my opinion, as in deciding the question of excision itself".

After three or four weeks, if it has been decided not to enucleate, besides the points mentioned above, the possibility of sympathetic ophthalmia developing must be taken into account. It is about this period, that is, from the third to the twelfth week, that sympathetic ophthalmia is most liable to occur. Now I do not intend to go into the question of the interesting subject of sympathetic ophthalmia, but merely to touch on it in so far as it must be considered in the after-treatment of these cases.

I am inclined to agree with the late Sir Henry Swanzy that sympathetic irritation and sympathetic inflammation are two entirely different conditions, after a study of this series of cases.

Many of these cases suffered from watering and irritation of the second eye, and there was no sign of sympathetic ophthalmia at the time or subsequently.

Swanzy[14] points out that sympathetic irritation may last an indefinitely long time without being followed by sympathetic ophthalmitis.

Further, although some sign or signs of sympathetic irritation often so precede the onset of sympathetic ophthalmia, yet in many cases such sign is wanting. In view of the latter fact it is therefore wrong to postpone the prophylatic enucleation until sympathetic irritation shows itsdf.

Of course, if the patient complains of irritation of the healthy eye, his statement is not to be ignored, the special points to be looked for being the presence or absence of ciliary injection, keratitis punctata, a normal state of adcommodation or an active pupil. The vision of the healthy eye should also be taken periodically in these cases, or when any complaint is made - hence the importance of having taken the vision when the patient first presented himself, and comparing it with the existing vision. An examination of the visual field of the healthy eye is also useful in these cases, a contraction of the visual field being sometimes one of the first signs of sympathetic ophthalmia. See case 33.

Any spindle-shaped enlargment of the blind eye should also be looked for. See case 33.

This is described in Maitland Ramsay's[15] book. He points out that, normally, when tested by a Bjerrum's screen, one-third of the spot is above the horizontal meridian, drawn the fixation point, and the vertical breadth of the spot is to

the horizontal breadth in the proportion of 6 to 4

Ramsay describes a case of sympathetic irritation where the spot became spindle-shaped, the corresponding proportion being 12 to 4. This was accompanied by marked conjestion of the disc and of the retinal vessels. Enucleation of the exciting eye, which showed the characteristic "sympathetic infiltration of Fuchs", was followed by a gradual recession of the spindle-shaped blind spot to the normal.

This condition is also described by Rowan and Sutherland.[16] In one of my two cases where sympathetic ophthalmia developed, (case 23), there was definite spindle-shaped enlargement of the blind spot, and the attack of sympathetic ophthal--mitis took the form of marked optic neuritis chiefly. A few of the cases, where the patient complained of irritation of the uninjured eye, showed only a tendency to the spindle-shaped enlargement of the blind spot, and some hyperaemia of the optic disc, but nothing so definite as the case mentioned (case 33). Very probably, as Ramsay suggests, this phenomenon is due to acute congestion of the optic disc, and is a danger signal which usually disappears on removal of the exciting eye.

I think that sympathetic ophthalmitis, although usually of the nature of plastic uveatis, may commence as an optic neuritis. Indeed, if the case is not severe, and the media are sufficiently

clear, one can often make out a definite optic neuritis in addition to the irridocyclitis, specially marked by the keratitis punctata, which is present, and this raises the question whether optic neuritis is not always present in these cases, but is unable to be made out owing to the hazy media, or the exudate in front of the lens, caused by the more obvious plastic uveatis.

To recapitulate. When a patient makes any complaint of the second eye, and in fact as a matter of routine, an examination of the eye should be carefully made, looking specially for any signs of irridocyclitis, optic-disc or retinal-vessel congestion, contraction of the visual field, spindle-shaped enlargement of the blind spot, loss of visual acuity and paresis of accommodation owing to early impairment of ciliary muscle.

I cannot leave this subject without mention-ing what appears to me to be an important factor in the early diagnosis of sympathetic ophthalmitis, viz.- a leucocytic blood count. It is only in the last few years that Gradle[17.] published the results of his study of the blood count in perforating injuries of the eye. Later, Price Jones and Browning[18.] described an increase in the large mononuclear cells of the blood in cases of sympathetic ophthalmitis. As has been pointed out by Coats[19.], on the analagy of the blood condition in syphilis, this may indicate a protozoal infection as the cause of sympathetic ophthalmitis.

Another point in favour of this view Coats

suggests that the incubation period of sympathetic ophthalmitis is unlike that of other most ordinary bacterial infections, but in the majority of cases is closely similar to that of syphilis. Still another point of resemblance is the occasional faculty which the noxa of sympathetic possess, of remaining latent over a prolonged period, and then breaking out in activity, like the tertiary stage of syphilis.

On the other hand, the histological structure characteristic of sympathetic ophthalmitis, so well described by Fuchs[20], is more nearly allied to that of the bacterial infection, tuberculosis, than to that of the protozoal infection, syphilis. Tuberculosis is an example of a bacterial infection with a prolonged incubation period, so that with regard to these points, the evidence for a bacterial versus a protozoal infection, is inconclusive. Coats mentions that, as a logical outcome of these speculations Price Jones and Browning recommend the treatment of sympathetic ophthalmia with Salvarsan, and describes three cases where this was tried. In the first, a severe case, it had practically no effect, but there was evidently some improvement in the other two, especially after a second injection.

More recently, Browning[21] points out that the original results of Gradle were of little value, because he did not sufficiently differentiate the various kinds of leucocytes. He (Gradle) simply differentiated between the Polymorphs and the Mononuclears

Browning points out that this method quite masks the chief point of the count in sympathetic ophthalmitis, viz.- the increase in the large Mononuclears

He found that in practically every case of sympathetic ophthalmia, there was a typical blood picture

There was a marked increase in the number of large Mononuclear-leucocytes, and some increase of the lymphocytes, while the Polymorphs were diminished.

The total white cell count did not vary much beyond the normal limits. He puts the average blood count in sympathetic ophthalmia as follows :

	Sympathetic.	Normal.
Polymorphs ...	54%	60 - 70%
Lymphocytes ...	28%	20 - 23%
Large Mononuclears ..	16%	2 - 5%
Eosinophiles ...	2%	2 - 4%
Mast cells ...	---	--- - .1%

He also points out the striking similarity between blood counts in certain protozoal diseases (malaria, syphilis, anchylostomiasis - especially marked out by the Eosinophilia - trypanosomiasis, kala-azar) and sympathetic. As the result of this similarity of blood count, and the similarity which I have referred to, in Coats paper, a large number of cases have been treated with "606" at Moorfields Hospital, and not only have the results been encouraging, the eye condition being at once relieved, but the blood count approached to normal.

Browning next proceeded to determine the time

interval between the perforating injury and the appear--ance of a pathological count, and also to determine whether the count could be used for an early diagnosis, or prognosis, of sympathetic ophthalmitis, in cases of perforating injuries of the eyes. As the result of his investigations, he found that the blood count showed marked changes at a time when there was still no other evidence pointing to the probable onset of sympathetic ophthalmitis. He points out that in doing periodical blood counts in a case of sympathetic ophthal--mitis, the blood count will remain normal for weeks, and then show all the signs of a typical protozoal count.

From this fact it is obvious that a normal blood count does not exclude the possibility of sympathetic ophthalmitis intervening. He was of opinion, however, that a positive count, namely an increase of the large mononuclears, is very ominous. As it is probable that in sympathetic ophthalmitis a sytemic infection has already occurred before the pathological eye changes appear, the blood count will afford a method by which this infection may be demonstrated before the sound eye becomes obviously diseased. He describes a case to illustrate this point. The patient had had a punctured wound of the left eye with retention of a small chip of steel which was removed by the magnet the same day as the accident (September 12th).

Blood count :

	Poly'ms.	Lymph'tes	Large Mon.	Eos'philes
Septr. 20th.	69%	23%	5%	2%
" 27th.	71%	20%	6%	3%

These are normal, but after this we find a change, especially in the large mononuclears :

		Poly'ms.	Lymphs.	Large Mon.	Eosino'les.
Septr.	28.	62%	20%	18%	
"	29.	59%	28%	10%	2%

At this date the right eye was noticed to be sensitive to light.

"	30.	63%	12%	24%	

At this stage the damaged eye was removed.

Octr.	2.	72%	14%	12%	
"	3.	71%	18%	9%	
"	4.	62%	25%	5%	

It is to be noticed how the blood count gradually dropped to normal after the removal of the exciting eye.

These results of Browning were supported by Sattler at the Heidleberg Congress, and Roller, working under Fuchs, came to the conclusion that the blood picture was a valuable diagnostic aid.

There is another means of aiding one in the diagnosis of the likelihood of sympathetic ophthal--mitis following enucleation of the injured eye, and that is the histological examination of the injured eye.

These changes were first described by Fuchs[22] which he describes as "sympathetic infiltration".

The cells taking part in the infiltration are the same as in the giant celled tubercule system - lymphocytes, epithelioid cells and giant cells - but made up together in irregular strands and tracts, rather than disposed with any regularity such as is found in the tubercular system.

The distribution is more or less character--istic - in the posterior layers of thr iris, in the outer part of the inner zone of the ciliary

body, and in the outer layers of the choroid.

Fibro-plastic exudate in the vitreous is the exception.

23.

Coats' experience after examination of these eyes is as follows :

(1) The most characteristic feature of all is the wide-spreadness of the inflammation, usually the whole of the uvea being involved, and he agrees with Fuchs that cases in which the choroid is free scarcely occur. In this connection sympathetic stands out in marked contrast to infective iritis, in which the severe inflammation of the iris is often associated with total exemption of the choroid. The patchiness of the infiltration is also very characteristic of ~~infiltration~~ sympathetic, at least in the early stages.

(2) Cases of true sympathetic undoubtedly occur which could not be diagnosed by the histo--logical character of the infiltration alone, in which the exudate in the uveal tract consists chiefly of plasma cells and lymphocytes. He had met with these cases chiefly in the sympathising eyes.

(3) On the other hand, if the changes described by Fuchs are present in typical form and distribution, there is scarcely any possibility of error. Practically the only source of confusion is tubercle when the resemblance of the histological picture may be very great. Again, a few cases of idopathic iridocyclitis with the histological changes of sympathetic have been

described by Continental writers. They must be very rare. In both these exceptions, however, the clinical history always excludes the possib--ility of error. Where there is a history of injury therefore, and where the changes described by Fuchs are typically present, the diagnosis of sympathetic ought to be made with the utmost confidence.

He cites three cases to illustrate this point, where sympathetic ophthalmitis followed enucleation of the 'first' eye, and where that ~~eye~~ presented the sympathetic inflammation to a marked degree, and where, therefore, the likelihood of sympathetic following was suspected, and later confirmed.

As I had only two cases of sympathetic ophthalmitis occurring in my series, I did not have much opportunity of following this work closely. I admit that I ought to have studied these cases more closely in view of the latest research as stated above by Browning.

The first case (case 9) had a large piece of steel embedded in the back of the right eyeball, and repeated attempts to move it by the magnet failed. Enucleation was advised, but the patient would not consent to this until a month after the injury. This was done, and the patient dismissed from Hospital.

One month later, i.e., two months after the original injury, the patient began to complain of pain in the left eye, and irritation in a strong light.

light. The pupil was active and dilated well and equally under homatropine, showing no adhesions. Only a few spots of keratitis punctata were present, but there was a definite optic neuritis, and the vision had fallen from $\frac{6}{6}$, taken at the time of the injury and at different periods subsequently, to $\frac{6}{12}$. He was re-admitted to Hospital, and I made an examination of the condition of his blood. I here append the results of this examination :

Polymorphs	...	46%
Lymphocytes	...	29.8%
Large Hyaline cells		21.2%
Transitional	...	2%

At that time I noticed that there was a relative lymphocytosis and a drop in the Polymorphs.

Now that Browning has published his results, one can see that, in this case, there was a distinct specific increase in the large Hyaline cells, or as Browning prefers to call them, "large Mononuclears".

This eye did well with large doses of salicylates, plus local treatment. The vision at one time $\frac{6}{36}$, improved ultimately to $\frac{6}{6}$ & J.1.

The swelling of the disc, at one time 3 D, became normal.

In the second case (case 39) the attack of sympathetic came on 8 months after the original injury, and the injured eye was enucleated one month after the injury. Here the type of sympathetic was of the nature of a severe plastic iridocyclitis, and progressed despite all

treatment till the vision was reduced to hand movements. I performed a blood count also on this patient when he developed sympathetic oph--thalmitis, but, although done on two separate occasions, I could find very little degression from the normal leucocytic count, such as I had found in the previous case. In this case the delaying of enucleation was due to the fact that, when the patient was first admitted, no X-ray plate was taken before the magnet was applied, and a small spicule of metal was extracted by the magnet, during my temporary absence from Hospital.

Naturally, it was thought that the foreign body had been removed in its entirety. It was only 23 days after the date of the injury that an X-ray plate was taken, when a large piece of metal was localized behind the eyeball. This, altho' an isolated case, illustrates the great importance of taking an X-ray plate before applying the magnet. As there was only one wound in this eye ball the probability was that a ragged piece of metal had entered the eye, and that s small spicule of it had become detached before it penetrated the posterior part of the globe.

If a plate had been taken before applying the magnet, the two pieces of metal would probably have been shown on the plate. Certainly, in any case, the size of the piece of metal, extracted on the first occasion, would not have corresponded with the X-ray picture, and would have put one on

guard and caused one to have advised earlier enucleation.

I consider these cases, where the metal has perforated the posterior part of the globe, dangerous, as far as sympathetic is concerned.

Both of my cases of sympathetic occurred when the metal was in this situation, although both eyes were enucleated as late as one month after the date of the injury. The ultimate result of the second case, when the vision of the remaining eye was reduced to hand movements after a distressing and painful illness, now slightly better, now worse, for several weeks, each attack causing further damage to the eye, is quite enough for any one who has seen such a case of sympathetic to have no qualms of conscience in advising early enucleation in these cases.

Since these two cases occurred I took blood counts from several other cases of perforating injuries, but, as the results were by no means uniform, more reliance was placed on early excision of the eyeball on naked eye inspection, and, having no more cases of sympathetic ophthalmitis, I lost interest in the subject somewhat, but, in the light of the recent researches of Browning, and supported by the competent observers whom he mentions in his paper I think this is a subject which should not be neglected.

Of course, these recently published results are no means generally accepted, but in view of the obscure pathology of sympathetic ophthalmitis I think that any light on this subject, however

small, should be accepted gladly.

Perhaps I may be pardoned for having rambled somewhat at this stage into the pathology of sympathetic ophthalmitis, but I think that all the points which I have mentioned have an important bearing in the after-treatment and prognosis of these cases. The only logical outcome that one can suggest is :-

First : To make a differential blood count in all cases of perforating injury to the eyes at regular intervals, and where a postive blood count - by positive I mean a relative increase in the large mononuclear-leucocytes - is found, to take steps to prevent the occurrance of sympathetic ophthalmitis by early enucleation provided that the condition of the eyeitself.has received due consideration. By receiving due consideration I mean that one would think twice before proceeding to enucleate an eye which ha s a visual acuity of say $\frac{6}{36}$, and where the metal has been lodged in, and been removed from, the anterior chamber, and the eye is looking well, even although a positive leucocytic blood count is present. When sympathetic ophthamitis has actually developed, whether the blood count is typical or not, I think, taking into account the successful cases which have been treated at Moorfields Hospital, that salvarsan is well worthy of a trial, after removal of the exciting eye, if that has not already been done.

Second : I would also advise histological examination, by a competent pathologist, of the injured eye, and where the typical infiltration of Fuchs is present, then the administration of salvarsan and careful observation of the remaining eye from time to time, combined with a guarded prognosis, and periodical examination of the blood, ought to be done.

With regard to the treatment of the second eye when sympathetic ophthalmitis has actually developed, I need only mention the removal of the first eye if this isstill present. Here a difficulty presents itself where the first eye has fair vision, and it may be a question whether it should be left in, as it may be, later on, the better seeing eye of the two.

With regard to the drug treatment of sympathetic ophthalmitis, salvarsan has been added to the long list. My first case of sympathetic seemed to improve rapidly on increas--ing doses of salicylates, as recommened by Gifford.[24] Of course, local treatment, including atropine fomentations, sub-conjunctival injections etc., are all necessary, and I only mention them as they are always used in any of these inflammatory conditions of the eyes.

With regard to the operative treatment of the "second" eye, it is important not to undertake any operative procedure, such as an iridectomy or removal of the lens until the eye has remained quiet for a considerable period, at least one

year, otherwise, by doing any such operation too soon, there is a good chance of stirring up the plastic iridocyclitis into renewed vigour.

PROGNOSIS :

It is important in all these cases of penetrating injury to the eyeball with retention of a foreign body, to give a guarded prognosis.

This will be seen from the results of my own cases, and from all statistics of these injuries. A penetrating wound, without rentention of a foreign body in the eye, inclines one to more hopeful prognosis as will be noticed from the 30 odd cases which I treated (see second list) These cases were not picked out, but were all the cases of this kind which were admitted to the Glasgow Eye Infirmary from 18th November 1911 to March 11th 1912. I took a note of these cases, and followed them up just to show the contrast of the results as compared with those in which a foreign body was present in the eye.

To the patient, or to any one not experienced in these matters, the removal of the foreign body by the magnet is apt to be thought as indicative that the worst of the trouble is over.

Personally, after removal of the foreign body, even of a very small spicule, lodged in the anterior chamber, I always tell the patient that the metal has been removed, but that it is very necessary to watch the eye carefully for a week

or two, at the very least, before one is able to give anything like a definite prognosis.

I think it well to show the patient the foreign body that one has removed, as in three separate cases tha patients would not believe that the metal had been removed when it came to a question of advising enucleation of the eye, the patients having a false idea that the metal was still in the eye, and was keeping up the inflammation. I think this is a small matter, and I only mention it as having come under my notice in dealing with workmen, somewhat ignorant in a matter of this kind.

Although, as I have mentioned before, the prognosis must be extremely guarded, I think that one is aided a good deal by consideration of the following points :

(1) This includes the first examination of the eye, the history, the X-ray plate, and the removal of the metal by the magnet.

First : The condition of the eye when the patient first presents himself. An eye which is hopelessly damaged, when first seen, of course, should be removed at once, and in a case of this kind the chance of sympathetic is rather remote.

Second : The time intervening between the date of the injury, and when the patient first presents himself.

Prompt treatment is important in these cases. An eye with signs of iridocyclitis or

hypopyon, already developed, by the time one sees the case naturally does not give a good prognosis.

In these cases the presence of the foreign body has set up inflammation in the eye, and also the foreign body has become more firmly fixed in the tissues of the eyeball, it is more difficult to remove, and its removal causes more injury to the structures of the eye than would be the case if the injury had occurred a few hours ago.

I am well aware that a foreign body can be retained in the lens and anterior chamber for years. Many of these cases have been recorded as I have mentioned previously, still, I think that the general experience is that the longer a foreign body remains in the eye, the less hopeful is the prognosis, especially where inflammation has been set up by its presence.

Third : Size and character of the foreign body.

Some authorities state that there is less likelihood of inflammation where the piece of metal is hot, as it is practically aseptic. I do not agree with this, taking these cases as a whole

Again, copper, more than iron or steel, is said to be notorious for setting up inflammation in the eyeball. Curiously enough my only copper case (case 2) where the foreign body was lodged in the sclera at the back of the eye, did exceedingly well, and retained useful vision when seen two years later, although repeated attempts, including a sclerotomy, at removal were unsuccessful

Of more important is the size and character of the metal. As one would naturally expect the larger the metal, the more damage does it inflict.

but I would qualify this statement by saying that I would give a more hopeful prognosis where a large scale of metal was lodged in the anterior chamber or iris, than where a small spicule had punctured the cornea or sclera and had lodged in the posterior part of the eye. I shall refer to this again under heading (4).

Like Wharton[25], I think these pieces of metal are best classified as "chunks", "scales" and "spicules". Spicules are, as a rule, easiest to remove, although they are rather apt to become entangled in the iris when drawing them into the anterior chamber.

As Rollet[26] has shown by a series of experiments, the shape of the metal influences its extradtion by the magnet more than the proportion in weight. He found that elongated bodies, such as needles, are more easily extracted by the magnet than small blocks, and this confirms the clinical experience that small spicules and scales are most easily extracted by the magnet.

Scales are apt to inflict considerable damage to the eyeball, as the edge cuts like a knife, and sometimes inflicts incised or punctured wounds of the lids before entering the eye. Sometimes they come out very easily, especially when they engage "edge on" to the magnet point. It is when they engage "broadside " on tnat difficulty is experienced, and if the manoeuvre, of which I have previously spoken, is

not successful, the wound, if attempts at drawing it into the anterior chamber are not successful, may require to be enlarged. Chunks are frequently of large size, and also inflict considerable damage.

Fourth : Position of the wound, and position of the metal in the eyeball.

These are important in the future prognosis particularly the latter, i.e., the position of the metal.

(1) Undoubtedly, the cases where there is a wound in the cornea and the metal has come to rest in the anterior chamber, iris or lens, are the most hopeful cases, both as regards the saving of the eye and useful vision being retained

In many of these cases the lens was injured, but even then, where the lens matter had been drawn off, a fully sized eye is left in the patient's orbit as a rule, and again, it may retain useful vision. This will be noticed on looking up the results of this class of case in the first list. I am quite convinced that the percentage of eyes noted as "saved", on looking into statistics in these cases of metal injury, depends on the number where the metal was lodged in the anterior part of the eyeball. The greater the number of cases where the metal is lodged in this region, the higher will be the percentage of eyes "saved".

The foreign body which lodges in the vitreous, usually sets up an iridocyclitis either

by its actual presence, or by its carrying in organisms as it pierces the conjunctival sac, which virtually always contains organisms of some sort. I have found in these cases of iridocy--clitis that, on taking a conjunctival culture, while occasionally more virulent organisms like Streptococcus and Staphlococcus may be present, in a great number of cases the culture tube yielded only B. Xerosis In view of these findings one can only suppose that the B. Xerosis has become more virulent when brought into contact with such a good culture medium as the vitreous humour.

Goulden[27] published results of 118 cases where the foreign body had been removed by the magnet. He pointed out that, if the foreign body was anterior to the vireous and the lens was uninjured, all the eyes were 'saved', and in none was the resultant vision less than $\frac{6}{12}$. He was of opinion that cases where the foreign body was lodged in the vitreous, having passed through the cornea, were more favourable as regards prognosis than where the foreign body was lodged in the lens

I do not agree with the latter statement after a consideration of my own results, and also the results of others.

Of my 55 cases, ten were cases of this sort, that is, where the foreign body was lodged in the anterior chamber, iris or lens, and, in every one of them the eye was 'saved', and in all,

useful vision was retained :

when lens was subsequently extracted
- six had a vision of $\frac{6}{6}$ to $\frac{6}{12}$,
- three ditto. $\frac{6}{24}$ to $\frac{6}{36}$, and
- one ditto. $\frac{4}{60}$.

(2) The ciliary region :

Of ten cases, eight eyes were 'lost' and two were 'saved'. Of the two saved, one had a vision of $\frac{6}{18}$, and the other was reduced to counting fingers.

A wound in this region has long been recognised as being serious. The direction of the wound, as causing more or less injury to the eye is to be noted; a meridional wound, other things being equal, causing less injury than oblique or equatorial wounds, as can readily be understood from the shape of the ciliary body.

Let us compare for a moment ciliary wounds with retention of a foreign body in the vitreous, with similiar wounds where a foreign body was not present (see second list). Of ~~44~~ 44 cases of this latter sort, only 4 eyes were enucleated, and ten were 'saved'. Of those saved :

8 had visual acuity ranging from $\frac{6}{9}$ to $\frac{6}{18}$,
1 do. of $\frac{1}{60}$, and
1 do. of perception of light,

even where the lens had subsequently been extracted in some of these cases. Therefore, I would state that, given a ciliary wound with prolapsed iris, etc., with no foreign body being present in the eyeball, provided that asepsis is carefully

observed, even although the lens is injured, and the wound carefully covered by conjunctiva after excision of all prolapsed iris, etc., these wounds are not so much more serious than corneal wounds, than is stated in the text-books. It is the presence of a foreign body in the vitreous which sets up damage, as a rule, and makes the injury so much more serious.

(3) Where the wound is corneal, and the foreign body usually small, has passed into the vitreous or into the orbit beyond, and frequently including the lens in its path of entrance, setting up traumatic cataract.

Of 18 cases of this sort, eleven were 'saved':

3 had a vision of $\frac{6}{9}$ to $\frac{6}{36}$,

3 had a vision of $\frac{2}{60}$ to $\frac{6}{60}$,

after the lens was extracted, and

5 had a vision of perception of light - counting fingers;

7 eyes were lost from plastic iridocyclitis.

I consider these cases quite as serious as those where the wound is in the ciliary region for the following reasons :

Firstly : The corneal wound being often very small, and especially if the lens has not been injured, attention may not be paid to the eye by the patient, or by the inexperienced observer, till a few days after the injury, when signs of iridocyclitis may have developed.

Secondly : As I mentioned previously, the

foreign body may have penetrated the posterior part of the eye, and lodged in the orbit beyond, and in these cases, the magnet is of no avail, so far as the removal of the foreign body is concerned.

Both of my cases of sympathetic developed cases of this sort, where the metal had lodged behind the eyeball. In one, the external wound was corneal, and in the other it was scleral.

In the case of the one with the corneal wound, the eye was enucleated a month after the date of the injury; in the case of the one with the scleral wound, twenty-nine days after the injury, owing to the non-consent of the patient to enucleation.

In these cases, the foreign body, owing to its passage through the structures of the eyeball usually sets up a virulent iridocyclitis.

Although, as I have mentioned before in one case a piece of copper was lodged in the back of the eye (case 2), and was noticed by the ophthal-moscope projecting into the vitreous, the eye remained perfectly quiet, and good vision was retained.

SCLERAL WOUNDS :

Of 17 cases of this sort, six eyes were 'saved'; three had a vision of $\frac{6}{9}$ to $\frac{6}{24}$, and three had a vision of perception of light to hand move-ments; eleven eyes were 'lost'.

Again I would put these cases in the same category as (2) and (3).

There is usually some loss of vitreous in these cases, especially where a large scale has inflicted the injury, and if the eye is saved, the vision is, as a rule, poor, and detachment of the retina is liable to follow.

To recapitulate. Cases where the metal is lodged in the anterior part of the eyeball, (anterior chamber, iris, lens or circum-lental space) give the most hopeful prognosis, whether the wound is in the ciliary region or not.

Cases where the metal is lodged in, or has passed through, the vitreous, whether the wound be ciliary, scleral or corneal, are to be approached with guarded prognosis from the first.

(5) The difficulty or ease with which the metal is removed by the electro-magnet, and the amount of damage inflicted to the eyeball at the time of operation.

This speaks for itself. Any necessary enlargement of the wound, laceration of the ciliary region causing troublesome haemorrhage, and later iridocyclitis, loss of vitreous, injury to the lens, or failure to remove the foreign body, must, of course, influence the prognosis.

All the preceding points with regard to prognosis help one in giving some idea of the prognosis at the commencement of the case, and I again emphasise the fact that, unless the metal is anterior to the lens, or in the lens, the prognosis must be extremely guarded, both as regards the possible loss of the eye, and if the eye is retained

as regards the resultant visual acuity, and the risk of sympathetic ophthalmitis subsequently.

(b) After an interval of two or three weeks, as a rule, except in a case where there is necessity for urgent removal of the eyeball, there comes the question of prognosis as regards any probability of sympathetic ophthalmitis developing.

As far as we know at present from records of reliable cases, the shortest interval which elapses between the injury of the 'first' eye and the onset of sympathetic ophthalmitis in the 'second' eye, is fourteen days, and very few cases with this short incubation period have been recorded.

The most dangerous period from all accounts seems to be somewhere between the sixth and twelfth week after the date of the injury. With regard to my two cases of sympathetic ophthalmitis occurring in this series of cases, in one case the eye was enucleated one month after the date of the injury, and the first sign of sympathetic ophthal--mitis was two months after the date of the injury.

In the second case the eye was also enucleated about a month after the date of the injury, and the first signs of sympathetic ophthal--mitis developed seven months after the original injury.

These two cases, small in number as they are, give one some idea of the considerable interval which may elapse between the date of the injury and the onset of sympathetic in the second eye.

26a.

According to Swanzy, in 170 of 200 cases collected by the Committee on sympathetic ophthal--mitis, of the Ophthalmological Society, the second eye was attacked within the first year after injury to the first eye. In only 12 of the 200 cases was the interval more than one year, and the longest was 20 years.

Just lately I have come across a case of sympathetic ophthalmitis, at the Blackburn and East Lancashire Infirmary which, apparently, developed 30 years after the injury to the first eye.

In the second of my two cases mentioned above, the appearance of sympathetic ophthalmitis in the second eye seven months after the injury to the first eye, shows the extremely complex nature of sympathetic ophthalmitis, and in a case of this sort, where the second eye becomes attacked after such a long interval, before diagnosing sympathetic ophthalmitis, I think it is well to consider the data which Swanzy lays down, and consider them collectively before giving a diagnosis.

26b.

These are as follows :-

First : The condition of the exciting eye, and the nature of the injury to that eye.

Second : The condition of the sympathising eye.

Third : The interval that has elapsed between the injury to the first eye, and the onset of sympathetic ophthalmitis in the second eye.

Fourth : State of the general system.

I may be pardoned if I have again entered into the domain of sympathetic ophthalmitis at this point, but it has an all important bearing in the prognosis, and in the after-treatment of these cases.

First : The condition of the exciting eye, and the nature of the injury to that eye :

Adhering strictly to the class of case, i.e injury with retention of foreign body, these are just the cases to give rise to sympathetic ophthal--mitis. I need scarcely allude again to the usual clinical picture of an eye which has had a piece of metal removed from it, and has had irido--cyclitis in it, now less acute, now flaring up at short intervals, the pupil not dilating so well under atropine, the iris tissue being less well defined and somewhat rusty looking, perhaps some punctate deposits on the back of the cornea, post synechiae and a hazy greenish vitreous, the tension falling and the vision practically nil, and frequently tenderness on pressure over the eyeball: later the soft eyeball becoming quadrangular in shape owing to the pull of the four rectus muscles.

This is the eye which is liable to give rise to sympathetic ophthalmitis, and enucleation should be advised; it is of no use to the patient, and, if left in, will degenerate into phthisis bulbi

An eye which goes on to panophthalmitis is rarely followed by sympathetic ophthalmitis, although, as I have mentioned previously, I have lately seen an exception to this rule. Presumably,

in panophthalmitis, the suppuration, caused by the staphylococcus or other organisms causing the suppuration, destroys the sympathetic organism, if we are to suppose that sympathetic is due to an organism.

Second : The condition of the sympathising eye :

The disease usually starts as an iridocyclitis of the plastic type. These cases are the worst from the point of view of prognosis. My second case of sympathetic was of this type, and ended with practically no vision in the eye.

Sometimes, in milder cases, there is what is termed serious iridocyclitis when the infection is mild, and often an optic neuritis can be made out. My second case conformed to this type, and the resultant vision was $\frac{6}{6}$, and J.1.

Third :

I have already spoken of this time interval.

Fourth : General condition of the patient.

Another cause of the iridocyclitis might be forthcoming in the patient being syphilitic, tubercular, etc.,

From these observations one can see that the patient cannot be regarded as being out of the wood, as regards the probability of sympathetic developing until at least a year has passed, ad should be told that on the slightest pain or failure of vision in the second eye, he should report himself.

As a rule these patients are not slow to do this on their own account, and frequently we find the eye looking quite well, but, if there is an element of

doubt, a blood count should be taken, to make out if there is an increase in the large mononuclears, and a reference ought to be made to the condition of the first eye if that has been enucleated, to see whether a 'sympathetic infiltration' was present or not.

I shall now give a very short description of these 55 cases classified under the following headings :

(1) Number of the case,

(2) The eye affected.

It is generally stated that in this class of injury the left eye is more frequently affected than the right. In these cases the left eye was injured in 29 cases, and the right in 26. I think the eye which is injured, depends a good deal on the occupation of the worker. A hammerman, for instance, who is striking at something in front of him, and swinging the hammer from right to left, will, of course, expose the left side of his face to injury more than the right.

(3) The position and character of the wound.

This must be looked at along with number (8), that is, the position of the foreign body, to get a proper idea of the prognosis and treatment as I have indicated under this heading. In the position of the wound, I have indicated special features where they have presented themselves as indicative of the presence of a foreign body in the eye, such as the small linear streak of Descemet's Membrane and the direction of the ciliary body or scleral wound - equatorial, oblique, etc.

(4) Other complications, and the special points under naked eye and ophthalmoscopic diagnosis.

Like the preceding (number (3)), I have picked out the special points suggesting the present of a foreign body in the eye, such as the 'hole of the iris' the 'vitreous tract', the penetrating wound of the lid, and also indicated the prognosis, for example, where the tension is much lowered, or where iridocyclitis had been present when the patient first presented himself.

(5) The visual acuity of the injured and uninuured eye.

In every case the visual acuity of the sound eye was taken, along with the visual acuity of the injured eye. This, again, is useful, as I have indicated elsewhere, in studying the subsequent progress of the injured eye, and also the falling off of the visual acuity of the good eye when sympathetic ophthal--mitis develops, besides being a good guide in the after examination of the case with regard to the Workmens Compensation Act.

(6) The time intervening between date of injury and the patient first presenting himself.

This, of course, influences the prognosis, as I have indicated elsewhere.

(7) The X-ray plate,

(8) Position of the foreign body,

Where no plate was taken, and where the plate was negative, such is indicated.

(9) Magnet and other operations and subsequent complications.

In magnet operations I have indicated the different measures which were adopted, such as I have

advocated under the heading of "Treatment by the magnet". Where another method was adopted the reason for so doing is indicated.

(10) Results two years afterwards,

Unless otherwise indicated, such as at the latter end of the series, these cases were examined either by myself over two years from the date of injury or I had the Infirmary record of the case up to that date when the patient did not turn up after receiving the post-card, or had changed his address.

I have numbered these different headings just in the way that one would go about a case of this sort, that is, a naked eye examination, taking of the visual acuity and history, the X-ray plate, and the operation by the magnet :

1.

Left.

Small central perforated corneal wound.

Lens cataractous.
Foreign body noticed in upper part of lens by ophthalmoscope.
Tension + .

Left : Counts fingers.
Right : $^{6}/_{6}$.

Four days.

Positive.

In lens.

No response to giant magnet outside.
Keratome incision above, and lens matter drawn off.
Iridectomy above and insertion of sharp curved point of magnet. Engaged small chunk of metal (3 x 2 mm).

Visual acuity of left, +10 D. sph. $\frac{6}{24}$,
Visual acuity of right, $^{6}/_{6}$.

SAVED.

2.

Left.

Small corneal vesicle in outer inferior quadrant.

Under homatropine, small localized cataract at a point behind corneal wound.
Pupil dilates well, except at a point behind wound where there is a dimple in the middle of the iris.
Tract of opacity through lens, and, by ophthalmoscope, small foreign body lodged in fundus below, and at outer side of disc.

Left : $\frac{6}{36}$. Right : $\frac{6}{6}$

Fourteen days.

Positive.

In globe at back of eye. COPPER.

Electro-magnet negative at all points outside.
Scleral puncture down and out, and insertion of sharp point of magnet produced no result.

Visual acuity of left : $\frac{6}{36}$. Localized cataract not progressed.
Foreign body, I.S.Q., Copper.
Visual acuity of right : $\frac{6}{6}$.

SAVED.

3.

Left.

Small central corneal puncture at upper part.

Slight hyphaema.
Opacity of lens above, and to inner side.
Tenderness above inner Canthus.

Left : Counts fingers at one foot. Right : $\frac{6}{6}$.

Same day.

Positive.

Outside eyeball. In orbit, above inner Canthus.

Electro-magnet - no result.
Two months later, a small bit of suppuration appeared above inner Canthus; this broke and small scale of metal came away.

Visual acuity of left : Counts fingers. (Cataract not removed).
Visual acuity of right : $^{6}/_{6}$.

SAVED.

4.

Left.

Large equatorial ciliary wound involving sclera and cornea at nasal side.

Prolapse of iris, shoroid and vitreous.
Soft and disorganised eyeball.

Left : Perception of light. Right : $\frac{6}{6}$.

Same day.

Positive.

Vitreous.

Electro-magnet, under chloroform anaesthesia. Large chunk (13 x 4 x 2 mm) removed through original wound.
Enucleation immediately after extraction of metal.

Visual acuity of right : $\frac{6}{6}$.

LOST.

5.

Left.

Large oblique ciliary wound, involving sclera and cornea.

Prolapse of iris and loss of vitreous.
Soft and disorganised eyeball.

Left : Perception of light. Right : $\frac{6}{9}$.

Same day.

Positive.

Vitreous.

Electro-magnet, under chloroform anaesthesia. Large chunk (15 x 4 x 3 mm) removed through original wound, which was enlarged.
Enucleation immediately after extraction of metal.

Visual acuity of right : $\frac{6}{12}$, H. astig.
Visual field for white, red and blue, evidently slightly contracted.
Eye looks well, and media clear. Blood count normal.
No discomfort.

LOST. 91.

6.

Right.

Meridonial scleral wound - ¼ inch - nasal side.

Penetrating wound of lid in front of wound.
Escape of vitreous.
Tension -.
Blood clot in vitreous.

Right ; Perception of light. Left : $\frac{6}{24}$, H. astig.

Same day.

Positive.

Vitreous.

Electro-magnet. Attempt to draw into anterior chamber unsuccessful.
Large scale (8 x 4 mm) extracted through original wound.
Conjunctiva sutured over wound

Right : Hand movements. Detachment of retina beneath site of original wound
Enucleation advised as pain at times.
Left : $\frac{6}{24}$, H. astig.

SAVED.

7.

Right.

Small penetrating corneal puncture at lower part of cornea.

Anterior chamber full.
Spincule noticed embedded in iris, with point in lens.

Right : $\frac{6}{24}$. Left : $\frac{6}{24}$, Myop. astig.

One day.

Positive.

Iris and lens.

Electro-magnet. No result externally.
Limbal section below at site of foreign body.
Point of magnet inserted and spicule (2 x 3 mm) extracted with difficulty as engaged in lens.
Prolapse of iris replaced.

Right : $\frac{6}{24}$. Localized cataract not progressed.
Left : $\frac{6}{24}$.

SAVED.

8.

Right.

Oblique ciliary wound involving sclera and cornea.

Hyphaema.
Iris prolapsed.

Right : Perception of light : Left : $\frac{6}{6}$.

Same day.

Positive.

Vitreous.

Electro-magnet. Scale (2 x 3 mm) drawn into anterior chamber and extracted.
Prolapsed iris excised.
Patient refused to remain in hospital after extraction of metal.

Right : Nil. Phthisis-Bulbi. Refused enucleation.
Left : $^{6}/_{18}$. Looks well, and no irritation. Visual field normal.

LOST.

9.

Left.

Small healed corneal scar at upper part.

Metal noticed in iris and lens.
Lens cataractous.

Left : Counts fingers. Right : $\frac{6}{6}$.

Four days.

No plate.

Lens.

Corneal section above, with iridectomy.
Extraction of scale (2 x 2 mm).
Ten days later lens matter drawn off.

Left : + 12 D. sph. $\frac{6}{36}$.

Right : $\frac{6}{6}$,

SAVED.

10.

Left.

Large oblique scleral wound at nasal side, near limbus.

Hyphaema.
Prolapse of iris.
Blood clot in vitreous.
Tension -.

Left : Perception of light. Right : $\frac{6}{6}$.

Same day.

No plate.

Vitreous.

Electro-magnet. Metal too large to be drawn into anterior chamber.
Large chunk (10 x 5 x 2 mm) extracted through original wound.
Enucleation a week after.
Plastic iridocyclitis.

Right : $\frac{6}{6}$.

LOST.

11.

Right.

Punctured wound of cornea - outer and inferior quadrant.

Anterior chamber full.
Small black object ((?) foreign body) in iris behind wound.

Right : $\frac{6}{12}$. Left : $\frac{6}{12}$. Old iritis.

Same day.

Negative.

Iris.

Corneal section near foreign body, and extraction of very small spicule ($\frac{1}{2}$ mm) by small magnet.

Right : $^{6}/_{12}$. Left : $\frac{6}{12}$.

SAVED.

le.

Left.

Oblique ciliary wound involving sclera and cornea.

Iris engaged in wound.

Left : Perception of light. Right : $\frac{6}{18}$.

Same day.

Positive.

Behind globe

Electro-magnet tried externally on day of injury and following day. No result.
Hypopyon.
Then scleral puncture done - only an indefinite dragging pain.
Seven days later enucleation.
Plastic iridocyclitis.
Thick scale (4 x 2 x 1 mm) in mass of fibrous material adhering to sclera behind
,acula.

Right : $\frac{6}{18}$.

LOST.

13.

Left.

Small perforating scleral wound - nasal side.

Vitreous a little hazy, but definite disturbance of the choroid pigment in retina at Bifurcation of inferior temporal vein.

Left : $\frac{6}{9}$. Right : $\frac{6}{9}$.

Same day.

Positive.

Behind eyeball.

Negative to electro-magnet on several occasions.
Only a little dragging pain.

Left : $\frac{6}{9}$. Right : $\frac{6}{9}$. Disturbance of pigment now suggests a hole in globe.

SAVED.

14.

Left.

Large vertical gaping ciliary wound, involving cornea and sclera.

Split lid in front of wound.
Prolapse of iris.

Large escape of vitreous.
Disorganised eyeball.

Left : Nil. Right : $\frac{6}{6}$.

Same day.

Positive.

In vitreous immediately behind wound.

Electro-magnet under chloroform anaesthesia. Large scale (12 x 8 x ½ mm) extracted through original wound.
Enucleation immediately after extraction of metal.
Lid stitched.

Right : $\frac{6}{6}$.

LOST.

15.

Left.

Large meridonial ciliary-corneal wound, at lower part.

Anterior chamber empty.
Lens cataractous.
Foreign body noticed penetrating iris and lens.

Left : Counts fingers. Right : $\frac{6}{36}$. H. astig.

Same day.

Positive.

In lens.

Electro-magnet. Thick scale (2.5 x 6.5 mm) extracted through original wound.
14 days later, lens matter drawn off.
3 months later, secondary matter needled.
6 months after injury, secondary matter again needled.

Left : C + 11 D. sph. $\frac{4}{60}$. Large corneal nebula obscures vision.
Right : $\frac{6}{24}$. No discomfort.

SAVED.

16.

Right.

Small healed linear corneal wound at nasal side in horizontal meridian, with white streak of Descemet's membrane.

Hypopyon, 1 mm.
Lens opacity behind wound.
Iris fixed and muddy.

Right : Perception of light. Left : $\frac{6}{6}$.

3 days ago.

Positive.

Behind
Bheind eyeball.

Electro-magnet externally, on first and sedond day after admission. No result, except dragging pain.
On second day sclerotomy produced no result.
Enucleation four days after.
Plastic iridocyclitis. Hypopyon.

Left : $\frac{6}{6}$. No complaint.

LOST. 102.

17.

Left.

Character of wound same as case No. 16, except the edges are pouting.
Near limbus at temporal side.

Hole in iris.
Blood clot in vitreous.
Air bubbles in vitreous.

Left : Counts fingers. Right : $\frac{6}{6}$.

Same day.

Positive.

Behind eyeball.

Electro-magnet - outside. Only dragging pain.
Electro-magnet through sclerotomy-wound - no result.
Enucleated five days after injury.
Plastic iridocyclitis. Hypopyon.

Right : $\frac{6}{6}$. No complaint.

LOST.

18.

Left.

Large lacerated oblique ciliary-corneal wound - nasal side.

Total hyphaema.
Prolapse of iris.
Tension -.

Left : Perception of light. Right : $\frac{6}{9}$.

Two days ago.

Positive.

Vitreous.

Large chunk (8 x 5 x 2 mm) extracted from corneal wound by anterior chamber route.
Prolapse excised.
Enucleated 12 days after.
Iridocyclitis.

Right : $\frac{6}{9}$. No discomfort.

LOST.

19.

Left.

Small scleral wound behind, and to nasal side.

Split wound of lower lid in front of wound. Vitreous escaping.
Tension -. Conjunctival ecchymosis. Blood clot in vitreous.

Left : Counts fingers. Right : $\frac{6}{6}$.

Same day.

Positive.

Vitreous.

Refused to stay in hospital. 3 days later admitted.
Electro-magnet. Piece of metal drawn into anterior chamber round nasal side of lens
Keratomy, and extracted chunk, 8 x 4 x 2 mm.
Iris prolapse excised. Enucleated 35 days after injury.
Soft, sightless, painful eyeball.

Right : $\frac{6}{6}$. No complaint.

20.

Left.

Small perforating (2 mm) corneal wound.
Central linear streak of Descemet's membrane.

Lens cataractous.
Point of rupture in anterior capsule made out.

Left : Counts fingers. Right : $\frac{6}{6}$.

Same day.

Positive.

Vitreous - posterior part.

Electro-magnet. Small scale appeared in anterior chamber.
No pain experienced by patient.
Extraction of scale (2 x 1 mm) by insertion of sharp point of magnet through small original corneal wound.
4 days later, soft lens matter drawn off.

Left : + 10 D. sph. $\frac{6}{60}$. Right : $\frac{6}{6}$.

SAVED.

21.

Left.

Small perforating wound of cornea, (2 mm), central.

Under atropine pupil dilates irregularly.
Showing posterior synechiae.

Left : Counts fingers. Right : $\frac{6}{6}$.

Three days ago.

Positive.

Posterior part of vitreous.

Electro-magnet. Small spicule (2 x 1 mm) drawn through the iris at 4 o'clock, leaving a hole in the iris.
Extracted through original wound in insertion of magnet point.

Left : Counting fingers. Vitreous opacities. Partially occluded pupil.
Right : $\frac{6}{6}$. No complaint.

SAVED.

22.

Left.

Small oblique ciliary wound (3 mm) at nasal side.

Prolapse of iris.

Left : $\frac{6}{12}$. Right : $\frac{6}{12}$.

Same day.

Negative.

Iris.

Electro-magnet. Spicule of metal (1 mm long) extracted from prolapsed iris. Prolapse replaced.

Left : $\frac{6}{12}$. Right : $\frac{6}{12}$.

SAVED.

23.

Left.

No visable wound.

History of having been struck in the eye with bit of metal.
Signs of acute iridocyclitis present, with exudate in pupillary area.

Left : Perception of light. Right : $\frac{6}{9}$.

Four days.

Positive.

Localized in sclera at outer part of eyeball.

When patient was admitted (in my absence for a fortnight) the electro-magnet was applied, and was negative at all points.
No plate was taken, and diagnosis of gonorrhoeal iritis was made.
After some improvement with local treatment and anti-gonococcic serum, patient was dismissed, after being four weeks in hospital.
Owing to recurrent pain and attacks of iridocyclitis, and the eye having practically no vision in it,, while patient was attending Out-patient department, enucleation was advised. He was re-admitted $2\frac{1}{2}$ months after injury for that purpose.
Before enucleation I took an X-ray plate, which was positive.
During enucleation, on hooking up the external rectus before dividing it, a piece of metal (3 x 2 mm) was found embedded in the sclera. It had probably travelled through, in an oblique direction from within outwards.

Visual acuity of right eye, two years afterwards : $^{6}/_{9}$.
LOST.

24.

Right.

Penetrating (5 mm) scleral wound. Nasal side.

Abrasion right side of nose. Penetrating puncture wound of inner end of upper lid in front of scleral wound. Tension -.
Ophthalmoscopic examination showed numerous blood clots in vitreous and apparently a large piece of metal.
Vitreous tract leading from wound to what appears to be the metal.

Right : $\frac{6}{36}$. Left : $\frac{6}{6}$,

Same day.

Positive.

Anterior part of vitreous.

Electro-magnet. Considerable difficulty in extraction of metal.
On first attempt to draw into anterior chamber, iris bulged on nasal side and corneal section, and iridectomy done, but metal would not come forward.
Next, on attempting to draw through original wound, the scale engaged 'broadside on' and probe had to be passed along the magnet point, to point the edge of the scale forward, when extraction was easy. Large scale (7 x 5 mm)
Scleral wound covered by conjunctiva. Two days later, signs of commencing panophthalmitis. Pus in lips of wound and in anterior chamber.
Enucleated. Socket douched with Hydrag. Perchloride (1 in 3000)

Visual acuity of left : $\frac{6}{6}$. No complaint.

LOST. 110.

25.

Left.

Ciliary wound (6 mm) (corneal s cleral).
7 o'clock on limbus.

Hyphaema. Irregular pupil.
Iris engaged in wound. 'Hole' in iris behind wound.

Left : Hand movements. Right : $\frac{6}{9}$.

Same day.

Positive.

Vitreous - posterior part.

Electro-magnet. Metal drawn into anterior chamber.
Iridectomy done, when iris bulged.
Extraction of small chunk (4 x 3x2 mm) through corneal part of wound.
Enucleation 22 days later.
Exudate in vitreous.
Iridocyolitis.

Right : $\frac{6}{9}$. No complaint.

LOST. .111.

26.

Left.

Scleral wound (5 mm) nasal side.

Escape of vitreous.
Tension -.

Left : $\frac{3}{60}$. Right : $\frac{6}{6}$.

Same day.

Positive.

Vitreous - posterior part.

Electro-magnet. Attempt to draw into anterior chamber not successful.
Easily extracted through original wound. Chunk 4 x 3 x 2 mm.
Conjunctiva sutured over wound.
Enucleated four days later.
Plastic iridocyclitis.

Right : $\frac{6}{6}$. No complaint.

LOST.

27.

Right.

Scleral (7 mm) down and in near limbus.

Hyphaema. Tension -. Large escape of vitreous.
Prolapse of choroid, and retina.
Disorganised eyeball.

Right : Shadows. Left : $\frac{6}{6}$.

Same day.

Positive.

Vitreous - anterior part.

Electro-magnet. Anterior chamber route not successful.
Extraction of large chunk through original wound (5 x 5 x 3 mm)
Enucleation two days later.
Disorganised eyeball.

Left : $\frac{6}{6}$. No complaint.

LOST.

28.

Right.

Cystoid scar (3 mm) in sclera at nasal side of limbus.

History of having been struck by chip of metal 10 days ago.
Right pupil smaller than left, but reacts well to light and dilates equally and well under homatropine. No iritis.
Ophthalmoscopic examination shows glistening substance in anterior part of vitreous at nasal side.

Right : $\frac{6}{12}$. Left : $\frac{6}{12}$.

Ten days ago.

Positive (?)

Anterior part of vitreous originally, then ciliary region, after first magnet operation.

Electro-magnet on admission. Sharp pain, but metal refused to come forwards into anterior chamber, becoming evidently fixed in the ciliary region.
Corneal section with point of magnet in anterior chamber - No result.
Then another plate taken - still positive - but shows foreign body further forwards - in ciliary region.
Second trial by electro-magnet. Corneal section. No result. Anterior chamber allowed to re-form.
Third trial by electro-magnet and corneal section (4 days after admission) and iridectomy above; extracted scale ($1\frac{1}{2}$ x $1\frac{1}{2}$ mm) with difficulty.

Visual acuity of right : $\frac{6}{24}$. Visual acuity of Left : $\frac{6}{12}$. No complaint.

SAVED.

29.

Right.

Small angular corneal wound at nasal side in horizontal meridian.

Iris engaged in wound.
Hole in iris behind wound.
Lens cataractous.

Right : Counts fingers. Left : $\frac{6}{6}$.

Same day.

Positive.

Vitreous - posterior part.

Electro-magnet. Foreign body drawn into anterior chamber, and extracted through original wound, slightly enlarged. Chunk (5 x 3 x 2 mm)
Enucleated eight days after.
Iridocyclitis.

Left : $\frac{6}{6}$. No complaint.

LOST.

30.

Right.

Small penetrating corneal wound, to nasal side.
Linear streak of Descemet's membrane.

Localized cataract.
Hole in iris behind wound.

Right : $\frac{4}{60}$. Left : $\frac{6}{9}$.

Same day.

Positive.

Vitreous - posterior part.

Electro-magnet. Foreign body drawn into anterior chamber, and extracted through original corneal wound.
Small scale ($1\frac{1}{2}$ x $1\frac{1}{2}$ mm).
Iris, engaged in wound, was snipped.

Right : $\frac{2}{60}$. (Cataract appears localized, and not progressed).
Left : $\frac{6}{9}$.

SAVED.

31.

Right.

Small penetrating corneal wound - upper and outer quadrant.
White streak of Descemet's membrane.

Hole in iris behind wound.
Right pupil contracted.
Lens cataractous.

Right : $\frac{4}{60}$. Left. $\frac{6}{6}$.

Same day.

Positive.

Vitreous - posterior part.

Electro-magnet. Foreign body drawn into anterior chamber.
Corneal section and extraction of small chunk (3 x 2 x 1 mm)
Prolapsed iris excised.
Ten days later, lens matter drawn off.

Right : $\frac{4}{60}$ $\breve{c}$ + lenses. Left : $\frac{6}{6}$. No complaint.

SAVED.

32.

Right.

Healed wound of sclera (5 mm) down and out.

Healed punctured wound of lower eyelid in front of wound.
Vitreous hazy.
Vitreous tract travelling from site of scleral wound backwards and inwards.

Right : $\frac{6}{18}$. Left : $\frac{6}{6}$.

9 days ago.

Positive.

Vitreous - posterior part.

Owing to iridocyclitis present, the metal was removed through the old scar which was re-opened. No loss of vitreous.
Since dismissal, when the eye looked well and the vision was 6/36, the patient has had recurrent attacks of iridocyclitis, and the retina became detached at the site of the wound.
Owing to these attacks of pain, and the eye becoming practically blind, enucleation was performed 6 months after the injury.

Visual acuity of left : $\frac{6}{6}$. Quiet.

LOST.

33.

Right.

Scleral (6 mm) nasal side of limbus.

Iris engaged in wound.
Tension −.

Right : Counts fingers. Left : $\frac{6}{6}$.

Same day.

Positive.

Behind eyeball.

Electro-magnet on admission caused dragging pain. No result, even when point inserted deep into wound. Eye remained fairly quiet for a few days, then had severe attacks of irridocyclitis. Enucleation advised, but no consent, until a month after admission, when eye was excised.
Patient complained, a month after enucleation, of pain in left eye. V.A right $\frac{6}{36}$.
No iridocyclitis, except a few spots of keratitis punctata, but marked optic neuritis. Swelling of disc, 3 D. Positive blood count (large hyaline cells, 21.2%). Spindle-shaped enlargement of blind spot.
Under local treatment, and large doses of salicylates, gradually improved and was dismissed.

Visual acuity of left eye, two years afterwards : $\frac{6}{6}$, and reads J, 1. No complaint
Ophthalmoscope shows faint pigment change at macula.
LOST, plus sympathetic.

34.

Left.

Small oblique penetrating corneal wound (8 mm). Temporal side.

Hole in iris, at outer part.
Media clear.

Left : $\frac{6}{18}$. Right : $\frac{6}{9}$.

Same day.

Positive.

Ciliary region at temporal side.

Electro-magnet. Foreign body drawn into anterior chamber, but, owing to the obliquity of corneal wound, it could not be extracted by original wound route. Limbal section, and extraction of small chunk, (2 x 2 x $\frac{1}{2}$ mm)

Right : $\frac{6}{12}$ (Corneal nebula).
Left : $\frac{6}{9}$. No complaint.

35.

Left.

Penetrating corneal wound at nasal side.

Piece of metal embedded in iris behind wound.

Left : $\frac{6}{12}$. Right : $\frac{6}{6}$.

Same day.

Positive.

Anterior part of eyeball and iris.

Limbal section opposite foreign body, and extraction of scale (2 x 1 mm) by weak current with small magnet.

Left : $\frac{6}{6}$. Right : $\frac{6}{6}$. No complaint.

SAVED.

36.

Right.

Angular corneal penetrating wound at upper and outer quadrant.

Piece of iris said to have been excised before admission.
Lens cataractous.

Right : $\frac{6}{36}$. Left : $\overline{6}$.

Same day.

Positive.

Anterior part of vitreous.

Electro-magnet. Foreign body drawn into anterior chamber.
Limbal section and extraction of scale (9 x 4 x 1 mm). Prolapsed iris excised.
Lens gradually became more opaque, but a month after dismissal, sight became much worse, when an extensive detachment of retina was found above and to outer side through hazy lens.

Right : $\frac{6}{6}$ Perception of light. Detachment of retina. No complaint.
Left : $\overline{6}$.

SAVED.

37.

Right.

Meridional penetrating scleral wound (3 mm) below centreof cornea.

Penetrating wound of lif in front of scleral wound.
Tension -.

Right : Shadows. Left : $\frac{6}{6}$.

Same day.

Positive.

Vitreous - posterior part.

Would not come into anterior chamber. Extracted through original wound, slightly enlarged.
Large chunk, 6 x 2 x 2 mm).
Loss of vitreous. Scleral wound covered by conjunctiva.
Sub-acute iridocyclitis.
Enucleated 11 days after injury.

Left : $\frac{6}{6}$. No complaint.

38.

Right.

Large corneal wound near temporal limbus.

Hyphaema. Iris engaged in wound.
Lens cataractous. Tension -.

Right : Perception of light. Left : $\frac{6}{6}$.

Same day.

Positive.

Vitreous - posterior part.

Only slight reaction to magnet externally.
Scleral puncture (near foreign body) not successful.
Secondary glaucoma came on suddenly from swelling of lens.
Lens matter drawn off, but the eye had acute iridocyclitis.
Ten days after injury was enuclated - small chunk in vitreous - non-magnetic.

Left : $\frac{6}{6}$ No complaint.

LOST.

39.

Right.

Penetrating corneal wound, lower and inner quadrant.

Iris engaged in wound.
Total hyphaema.

Right : Hand movements. Left : $\frac{6}{6}$.

Same day.

Positive. (taken <u>after</u> magnet operation).

Behind eyeball.

Electro-magnet at first gave a 'full' feeling, then a small scale (3 x 2 mm) extracted by anterior chamber route. Iris snipped.
23 days after the magnet had been applied (as the eye was still irritable) an X-ray plate was taken, and showed foreign body apparently behind eyeball.
Electro-magnet again applied, but no result.
Enucleation done 1 month after date of injury. Iridocyclitis. Metal scale adhering to back of eyeball. Eight months after injury to right eye, sympathetic iridocyclitis developed in left - a severetype - and ultimately ended in complete destruction of the eye as far as vision was concerned.
Two blood counts normal as far asincrease in large Hyaline cells was concerned.

Visual acuity two years afterwards : Right eye enucleated, and hand movements in left as result of sympathetic.

LOST, plus sympathetic.

40.

Left.

Small perforating corneal (4 mm) wound, upper and inner quadrant.
White streak of Descemet's membrane.

Hole of iris behind wound.
Lens cataractous.

Left : Counts fingers. Right : $\frac{6}{6}$.

Same day.

Positive.

Vitreous - posterior part.

Electro-magnet. Metal drawn into anterior chamber.
Limbal section and extraction of scale (4 x 2 mm)
Enucleation 25 days afterwards.
Iridocyclitis, vitreous exudate, etc.

Right : $\frac{6}{6}$. No complaint.

LOST.

41.

Right.

Small penetrating corneal wound, lower and outer quadrant.

Hole of iris behind.
From this point of puncture of the iris, the tract of opacity travels backwards and inwards through the lens.

Right : $\frac{6}{12}$. Left. $\frac{6}{6}$.

Same day.

Positive.

Posterior part of vitreous. In globe.

Electro-magnet. No result when magnet applied externally.
Scleral puncture down and in, and extraction of small scale (2 x 1 mm).
Soft lens matter drawn off later.

Right : C 12 D. sph. $\frac{6}{9}$. Left : $\frac{6}{6}$.
16 D. sph. J, 1.

SAVED.

42.

Right.

Oblique scleral wound just below lower limbus.

Wound now partially healed. Iris hazy. Cornea steamy. Small hypopyon. Pupil sluggish.

Right : Hand movements. Left : $\frac{6}{6}$.

3 days ago.

Positive.

Vitreous - high up.

Electro-magnet. Owing to before mentioned signs of inflammation in the vicinity of the anterior chamber, superior sclerotomy was done, and extraction of small scale (4 x 3 mm). Eye shows a tendency to soften, and ciliary tenderness. Euncleation advised, but refused.

Right : Perception of light. Soft eyeball.

Left : $\frac{6}{6}$. No complaint.

SAVED.

43.

Left.

Oblique scleral wound (3 mm) down and in.

Punctured wound of lid in front of wound.
Vitreous hazy and numerous blood clots in it.
A separation of retina made out, down and in, behind site of wound.
Tension -. (?). Visual field defective, corresponding to this point.

Right : Perception of light. Left : $\frac{6}{6}$.

Same day.

Positive.

Vitreous - outer side - behind.

Electro-magnet. Metal drawn into anterior chamber round temporal side of lens.
Iridectomy before drawing into anterior chamber.
Extraction by corneal section, chunk (5 x 3.5 x 3 mm).
Enucleation 3 months later owing to soft and tender eyeball, also because of some pain in right eye.

Right : $\frac{6}{6}$. No complaint.

LOST. 129.

44.

Left.

Corneal wound (5 mm) in lower and inner quadrant, near limbus.

Iris engaged in wound.
Cornea and iris hazy.

Left : Counts fingers. Right : $\frac{6}{24}$, H. astig.

1 day ago.

Positive.

Vitreous - posterior part.

Electro-magnet. No response externally.
Sclerotomy down and in, and extraction of scale, (4.5 x 3 x 1 mm).
Engaged iris snipped.
Was dismissed with vision of fingers at 12 feet.
Enucleation advised, owing to recurrent iridocyclitis, but refused.
A year later developed a hypopyon ulcer owing to new injury (?).

Left : Perception of light (large corneal nebula). No complaint. Right : $\frac{6}{6}$.

SAVED.

45.

Left.

Ciliary wound (3 mm) outer side.

Pupil displaced slightly, owing to engaged iris.
Anterior chamber empty.

Left : Counts fingers. Right : $\frac{3}{60}$, Hyper. astig.

Same day.

Positive.

Vitreous - posterior part.

Electro-magnet. Scale (3 x 2 mm) extracted by original wound, owing to empty anterior chamber.
Conjunctiva sutured over wound.
Eye healed well. No iridocyclitis.

Left : Counts fingers (large vitreous opacities).
Right : $\frac{3}{60}$ + 8 D. sph. 1.5 cy.V. $\frac{6}{18}$.

SAVED.

46.

Left.

Ciliary wound (4 mm) involving cornea at lower part of limbus.

Tension -.
Iris engaged in wound.
Lens cataractous.

Left : Hand movements. Right : $\frac{6}{9}$.

Same day.

Positive.

Vitreous - posterior part.

Electro-magnet. Metal drawn into anterior chamber and extracted (4 x 3 mm)
Prolapse excised.
Wound covered by conjunctiva.
Cataract extracted 5 months after injury.

Left : + 10 D. sph. + 1 D. cyl. h. = $\frac{6}{18}$. Eight : $\frac{6}{9}$.

SAVED.

47.

Left.

Central penetrating corneal wound.
White streak of Descemet's membrane.

Lens cataractous.
Anterior chamber almost empty.
Tension -.

Left : Hand movements. Right : $\frac{6}{9}$.

1 day ago.

Positive.

Vitreous - posterior part.

Electro-magnet. Scale (2 x 1 mm) drawn through cataractous lens into anterior chamber. Corneal section and extraction.
Soft lens matter drawn off 14 days later. Loss of some vitreous.
Eye kept well until 8 months after injury, when hyphaema developed and eye became soft
Enucleated 9 months after injury.
Painful and soft eye, with no vision.

Right : $\frac{6}{9}$. No complaint.

LOST .

48.

Right.

Small ciliary wound (4 mm) involving cornea at lower part.

Lens cataractuus.
Iris muddy.

Ciliary injection.
Iris engaged in wound.

Right : $\frac{6}{36}$. Left : $\frac{6}{6}$.

3 days ago.

Positive.

Vitreous - posterior part.

Electro-magnet. (scale 3 x 3 mm) drawn into anterior chamber.
Corneal section and extraction.
Enucleation advised early. Patient did not consent.
Softening eyeball, with ciliary tenderness. No vision.
Four months after injury some watering and injection of left eye. No keratitis punctata, but disc hyperaemia. Blood count normal. Blind spot normal.
Enucleation one year after injury.

Left : $\frac{6}{9}$. No complaint. Looks well.

49.

Right.

Small healed wound of cornea below.
White streak of Descemet's membrane well seen, although corneal wound now healed.

Hole of iris behind wound. Lens opaque.
Iris muddy. Good deal of ciliary injection. Pupil fixed.

Right : Counts ffngers. Left : $\frac{6}{12}$.

A week ago.

Positive.

Vitreous - anterior part.

Electro-magnet. Corneal section, (because foreign body well forward, otherwise a posterior sclerotomy would have been done owing to anterior uveatis), after drawing foreigd body into anterior chamber.
Extraction of small scale (3 x 2 mm).
22days later soft lens matter drawn off.
Good deal of pupillary exudate in lens matter, occluding pupil.
Needled 9 months after injury.

Right : Hand movements. Left : $\frac{6}{12}$. No complaint.

SAVED.

50.

Left.

Scleral wound (5 mm). Temporal side.

Tension -.
Loss of vitreous.

Left : Hand movements. Right : $\frac{6}{18}$. H. astig.

Same day.

Positive.

Vitreous - posterior part.

Electro-magnet. Large scale (12 x 5 mm) extracted through original wound (metal too large to be drawn into the anterior chamber), which was enlarged. Considerable haemorrhage.
Enucleation 9 days later.
Soft eye with vitreous exudate.

Right : $\frac{6}{18}$. No complaint.

LOST.

51.

Right.

Penetrating equatorial scleral wound - temporal side.

Tension - 2.
Loss of vitreous.

Right : $\frac{6}{60}$. Left. $\frac{6}{6}$.

Same day.

Positive.

Vitreous - posterior part.

Electro-magnet. Large scale 5 x 4 mm extracted through original wound.
It 'locked', and was extracted with difficulty.
Got detached retina below, and to outer side, a month after extraction of metal.

Right : Counts fingers at 18". (Detachment of retina). Left : $\frac{6}{6}$.
Examined six months after date of injury. No complaint.

SAVED.

52.

Right.

Punctured corneal wound, upper and inner quadrant.

Foreign body sticking in iris behind wound.
Anterior chamber full.

Right : $\frac{6}{9}$. Left : $\frac{6}{9}$.

1 day ago.

Positive.

Iris.

Keratomy and extraction of metal with weak current, and small magnet.
Spicule 2 x $\frac{1}{3}$ mm.

Right and left : $\frac{6}{9}$. Examined six months after date of injury.

SAVED.

53.

Right.

Small linear corneal wound (2 mm) upper and outer quadrant.

Foreign body in iris behind wound.
Anterior chamber empty.

Right : $\frac{6}{12}$. Left : $\frac{6}{12}$.

Same day.

Positive.

Iris.

Extraction of metal (2 x 1 mm) through original wound by insertion of magnet point

Right and left : $\frac{6}{12}$. No complaint.
Examined five months after date of injury.

SAVED.

54.

Right.

Punctured scleral wound (2 mm) lower and inner side.

Punctured wound of lid in front of wound. Tension -.
Choroid pouting from edges of wound. Intense chemosis of conjunctiva.
Threatening panophthalmitis.
Iris muddy and streak of pus over it.

Right : Hand movements. Left : $\frac{6}{6}$.

2 days ago.

Positive.

Well behind eyeball, outer side of orbit.

Owing to threatening panophthalmitis, enucleation done straight away.
Point of exit of metal at posterior part of globe to outer side of macula.

Left : $\frac{6}{6}$. No complaint.
Examined three months after date of injury.

LOST.

55.

Right.

Very small punctured wound of sclera at inner side.

Vitreous hazy and contains much blood clot. Apparently a detachment of retina to inner side. Defect of visual field at this part.
Air bubbles in vitreous.

Right : $\frac{6}{60}$. Left. $\frac{6}{6}$.

Same day.

Positive.

Behind eyeball.

Electro-magnet. No result except dull pain.
After vitreous cleared the detachment of retina under site of entrance wound was confirmed, and point of exit through back of eye identified as a black spot to outer side of disc, near macula.
A fortnight after the injury the retina became ~~detached~~ reattached, the eye remaining quiet, and the vision improved to $^{6}9$.

Right : $\frac{6}{9}$. Left : $\frac{6}{6}$. Curious marked pigmentary disturbance round macula where the exit wound is now identified by a large mass of pigment.
No complaint.
Examined two months after injury.

SAVED.

1. Number of case.

2. Eye affected.

3. Position and character of the wound.

4. Other complications and special points on naked eye and ophthalmoscopic diagnosis.

5. Visual acuity of injured and uninjured eye.

6. Time intervening between date of injury and patient first presenting himself.

7. X.-ray plate.

8. Position of foreign body.

9. Magnet and other operat--ions, and subsequent complications.

10. Results two years after--wards.

The following points are brought out in an analysis of these cases :

First : 28 eyes were saved, 27 eyes were lost, i.e. 50.91% and 49.09% respectively.

Second : Visual acuity of the eyes saved :

16 had useful vision,

in 13 the vision ranged from $\frac{6}{6}$ to $\frac{6}{24}$,

in 3 the vision ranged from $\frac{6}{36}$ to $\frac{6}{60}$

in 3 the vision ranged from $\frac{4}{60}$ to $\frac{2}{60}$, and

in 9 the vision ranged from the counting of fingers to perception of light.

Third : Of the eyes lost, eight were enucleated on admission as hopelessly disorganised eyeballs, or within three days, when signs of commencing panophthalmitis presented,

one went on to panophthalmitis,

twelve were enucleated within three weeks of the injury from plastic iridocyclitis,

six were enucleated after dismissal as atrophic, sightless eyeballs, with ciliary tenderness.

Fourth : Two cases of sympathetic occurred.

One was of the milder type, optic neuritis in character, and did well, with a resultant visual acuity of $\frac{6}{6}$, the other, a severe case of the plastic iridocyclitis type, ended in almost total visual destruction of the eye, the resultant visual acuity being perception of light.

Fifth : The results according to the position of the wound, and the position of the metal.

I have already referred to this under the heading of "Prognosis".

Sixth : The X-ray plate was doubtful in case 28, and negative in cases 11 and 22. No plate was taken in cases 9 and 10. With these exceptions the X-ray plate was positive.

For comparison I have here tabulated a second list of 30 cases of penetrating injuries to the eye by metal, but where the metal was not retained in the eye the X-ray plate and magnet being negative in each case.

The following are the points to be noticed :

First : 23 eyes were saved, and only 7 eyes were lost, equalling 77% and 23% respectively.

Second : Of the eyes saved, 20 had a vision of from $\frac{6}{6}$ to $\frac{6}{60}$, and three from $\frac{1}{60}$ to perception of light.

Third : No case of sympathetic occurred.

A comparison of this list with the first shows that, irrespective of the size and position of the wound, the prognosis is infinitely better, both as regards the saving of the eye, the resultant vision, and the risk of sympathetic, provided that asepsis is carefully observed, and the wounds covered by conjunctiva.

No. of case.	Date of injury.	Eye affected.	Visual acuity.	Position of wound, and damage.	Operation.	Result, with visual acuity.		Date when last seen.
1.	7.12.11	Right.	Shadows	Large. Cornea and ciliary region. Prolapse of iris. Lens cataractous.	Excision of pro-lapsed iris.	Enucleated.	Quiet.	26.2.12.
2.	4.12.11	Right.	Shadows.	Large. Cornea and ciliary region. Prolapse of iris and vitreous. Lens cataractous.	Excision of pro-lapsed iris, and later, soft lens matter drawn off.	Enucleated.	Quiet.	29.2.12.
3.	2.12.11	Right.	$\frac{6}{12}$.	Cornea and ciliary region.	Wound covered by conjunctiva.	$\frac{6}{12}$.	Quiet.	6. 1.12.
4.	27.11.11	Right	$\frac{6}{60}$.	Large corneal. Prolapse of iris.	Excision of pro-lapsed iris. Covered by conjun-ctiva.	$\frac{6}{18}$.	Quiet.	1. 2.12
5.	25.11.11	Right	$\frac{6}{60}$.	Cornea and ciliary region. Prolapse of iris.	Ecision of pro-lapsed iris, and conjunctiva sutured.	Few cataract streaks behind wound. $^6/_{20}$.	Quiet.	21. 2.12.
6.	18.11.11	Left.	$\frac{6}{36}$	Sclera and ciliary region. Prolapse of vitreous	Conjunctiva sutured over wound.	$\frac{6}{9}$.	Quiet.	2.2.12.
7.	17.11.11	Left	$\frac{6}{36}$	Sclera. Prolapse of vitreous.	Conjunctiva sutured over wound.	$\frac{6}{5}$.	Quiet.	12.1.12
8.	16.11.11	Right	Fingers	Cornea. Lens cataractous.	Soft lens drawn off (24.11.11)	Quiet. V.A.right = fingers. C + 12 D.sph. + 2 Dupl. 1.=18		7.3.12.

1.	2.	3.	4.	5.	6.	7.	8.
9.	16.11.11	Left	6/60.	Prolapse of iris. Limbus and ciliary region.	Prolapsed iris exc--sed. Conjunctiva sutured.	6/9. Quiet.	25.1.12
10.	6.11.11	Right	6/60	Prolapse of iris cornea and limbus.	Prolapse excised. Conjunctiva sutured.	6/18. Quiet.	29.1.12
11.	18.10.11	Right	Shadows	Cornea, Hymphaema Prolapse of iris.	Panophthalmitis, (19.10.11)	Enucleated. Left, quiet	21.2.12
12.	4.10.11	Left	6/60.	Cornea. Prolapse of iris.	Replaced iris. Conjunctiva sutured.	Left : 6/18. Quiet.	11.11.11
13.	21.2111.	Left.	6/18	Cornea, Anterior chamber empty.		6/12. Quiet.	16.3.12
14.	16.2.12. Accident 3 days ago.	Right.	Perceptn. of light.	Cornea. Iris adhere to wound. Lens cataractous.	Iris snipped. Soft lens drawn off.	Quiet. Black pupil. + 10 D. sph. 6/36.	15.3.12
15.	9.2.12.	Left.	3/60	Cornea. Prolapse of iris. Vitreous. Lens catractous.	Excision of prolap--sed iris.	6/12. Quiet.	15.3.12
16.	30.1.12	Right	6/18	Limbus. Prolapse of iris.	Excision of prolap--sed iris. Conjunctiva sutured.	6/18. Quiet.	15.3.12
17.	29.1.12	Left.	Perceptn. of light.	Cornea, Prolapse of iris. Lens cataractous.	Excision of prolap--sed iris.	Lens cataract station--ery. Perception of light.	14.3.12
18.	27.1.12	Left.	6/18.	Cornea. Iris adherent.	Iris freed.	6/12. Quiet.	21.2.12

1.	2.	3.	4.	5.	6.	7.	8.
19.	25.1.12	Left.	Perception of light	Cornea. Prolapse of iris. Lens catractous.	Enucleated.	Right, quiet.	11.3.12
20.	30.12.11	Right	Perception of light.	Cornea and limbus.	Enucleated.	Left, quiet.	1.3.12
21.	2. 1.12	Right	Hand move--ments.	Cornea. Prolapse of iris, Lens catractous.	Iris replaced, Lens cataract drawn off.	+ 10 d.sph. $\frac{6}{36}$. Quiet.	15.3.12
22.	2.12.11	Right	$\frac{6}{20}$	Cornea. Iris prolapsed. Lens cataractous.	Excision of prolapsed iris.	Cataract progressed but slowly. $\frac{1}{60}$. Quiet.	8.3.12
23.	14.12.11.	Right	$\frac{6}{18}$	Iris engaged in wound.	Replaced.	$\frac{6}{18}$ Quiet.	15.3.12
24.	27.2.12 2 days ago.	Left.	$\frac{6}{24}$	Cornea. Iris adherent and hypopyon.	Enucleated.	Right, quiet.	18.3.12
25.	1.3.12.	Left.	$\frac{6}{60}$	Corneal wound. Engaged Iris a week ago.	Cautery.	$\frac{6}{24}$. Quiet.	15.3.12
26.	27.2.12 7 days ago.	Left.	Perception of light	Cornea, Prolapse of iris, Lens cataractous.	Prolapsed iris excised. Cautery.	Fingers. Quiet.	12.3.12
27.	27.2.12.	Left.	$\frac{6}{18}$.	Cornea (small) Opacity in lens.	Nil.	$\frac{6}{18}$ Quiet.	15.3.12
28.	11.3.12.	Left.	$\frac{6}{9}$	Ciliary region, Vitreous prolapse.	Conjunctiva--suture.	$\frac{6}{9}$ Quiet.	20.4.12

1.	2.	3.	4.	5.	6.	7.	8.
29.	9.2.12.	Right	Fingers.	Cornea, Blood in vitreous, Adherent iris, Lens cataractous.	Lens cataractous, drawn off. Iris freed.	$\frac{6}{24}$ Iris adherent, Quiet.	1.3.12
30.	27.2.12. 2 days ago.	Left.	Hand move- -ments.	Ragged wound of ciliary region, Lens cataractous, Prolapse of iris.	Prolapse excised. Conjunctiva-sut- -ure.	Iridocyclitis, Enucleated.	15.4.12.

C O N C L U S I O N S :

The points that I would specially draw attention to in this connection are as follow :

(1) the urgent necessity of measures being universally adopted to prevent, or at least to minimise, the risk of these injuries occurring at all.

A perusal of my own cases, and of the various journals of Ophthalmology, where results of magnet operations appear from time to time, will show that the results are bad, both as regards the saving of the eye, and as regards the vision if the eye has not been enucleated. It was thought that the introduction of the giant magnet would remedy these matters somewhat. That it does so, as regards rendering the removal of pieces of metal at the posterior part of the eye more easy, there is no doubt, but the slow iridocyclitis, which so frequently follows the extraction of the metal, either necessitates enucleation of the eye subse--quently, or seriously affects the visual power of the eye, with the risk of sympathetic ophthalmitis, if it has been decided that the eye should be retained. One can quote the results of many authorities to emphasise this point. I need only quote two. For example, Rollet [29.] :

Of 18 cases, only 5 had useful vision left, and Wharton [30.], of 55 cases, 33 eyes were saved, and of these 21 had useful vision. The former results are rather bad, and the latter somewhat better, but far from ideal.

For these reasons then, I think that workmen, employed in an occupation where the risk of being struck on the face with a chip of metal is possible, should wear some protection in the shape of thick plain glasses, to divert the path of a ~~alying~~ flying splinter. Horn spectacles, I am afraid, would rather interfere with their work.

Provided the glasses were sufficiently thick and compatible with the carrying out of their work satisfactorily, I do not think there is much risk of the glasses breaking and injuring the eyes, - rather a rare injury as has been pointedout by Leuber.[31] He quotes Hirschberg, who mentions a case in which a chip of metal weighing 6020 milli--grammes had shattered the glasses, but left the eye intact.

I am quite aware that protective measures of this sort are used in many workshops, but the system ought to be universally adopted and enforced in every industry of this sort.

(2) The great importance of early diagnosis of a foreign body in the eye.

Provided that the matter be gone about in the methodical way I have described, the presence of a chip of metal in the interior part of the eyeball can be recognised with, in half an hours examination at the most, in the great majority of cases, in a well equipped hospital, and its removal carried out immediately, thus lessening somewhat the possibility of future complications.

(3) The necessity of giving a guarded prognosis, especially in those cases where the metal is posterior to the lens, as regards the possibility of subsequent enucleation, serious defect of the vision of the eye, and the possibility of sympathetic ophthalmitis.

(4) With regard to sympathetic ophthalmia, in addition to the usual signs mentioned in text-books :

(a) The importance of a differential blood count being taken at periodical intervals after the metal has been extracted until the eye has got completely well.

(b) The importance of having an eye, from which a piece of metal has been extracted, and which subsequently has developed a plastic irido--cyclitis necessitating enucleation, examined by a competent pathologist, to find out if there is any sign of the typical Sympathetic infiltration of Fuchs.

(c) When the patient at any future date makes a complaint of the uninjured eye, again the importance of a differential blood count, and of a reference being made to the pathological condition of the injured eye, if such has been enucleated.

(d) In view of the recently published results of treatment by these drugs, the importance of salicylates and salvarsan in the treatment of sympathetic ophthalmia, in addition to the usual local treatment which is being carried out.

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