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OPERATION FOR CATARACT

Closure of the Wound. Frequency of Complications with Different Methods of Extraction

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OPERATION for cataract—which has already reached a high standard—is still not entirely free from danger, the elimination of which would be an important achievement. Only clinical experience can furnish us with the knowledge necessary for further improvement.

A statistical survey of a large number of cases should provide us with a sound critical basis, and may indicate the direction for further improvement in technique. Furthermore, observation of patients over a long period may shed light on the circumstances in which complications occur, and may indicate the measures requisite for their prevention. Complications and their treatment are of the utmost importance, not only because they increase the difficulties and anxieties of the surgeon, but chiefly because the outcome of the complications plays a part in the final result of the operation.

This review is based upon 650 cataract operations which were performed in the Ophthalmic Department of the Jewish Hospital in Budapest, between 1933-1938. Of these 650 operations 265 were upon men and 385 upon women. The age of the patients varied from 25 to 91 years. Details are given in Table I.

With regard to the physical condition of the patients 12.5 per cent. were diabetic and in 6 per cent. there was pre-existent glaucoma. The incidence of hyperpiesia and other diseases was in accordance with the general distribution.

The pre-operative treatment consisted of a general examination of the patient and the bacteriological examination of the conjunctiva. In the general overhaul constitutional factors as well as diseases must be considered. As a routine, consideration should

TABLE I

Age	Male	Female	Total
21-25	4	—	4
26-30	—	—	—
31-35	1	6	7
36-40	2	6	8
41-45	5	7	12
46-50	13	19	32
51-55	15	16	31
56-60	30	41	71
61-65	49	56	105
66-70	44	82	126
71-75	52	82	134
76-80	35	51	86
81-85	14	11	25
86-	1	8	9
Total ...	265	385	650

Mean : 66 ± 0.35 $\sigma = 13.25$

be given to urine, blood pressure, coughing, bowels, blood-sugar in case of diabetes, and other tests if necessary. The patient was admitted a few days before operation and made as fit as possible. If the conjunctiva was not clean ung. hydr. flav. dil. with bandage was used. In patients sensitive to mercury, noviform ointment was used as a conjunctival antiseptic with satisfactory results. The patient's co-operation should be secured by exercises such as gentle closing of the lids, making the patient look down, and practice with eye drops. Twenty centigrams of luminal was given the night before, and the same dose an hour before operation.

Anaesthesia.—Half an hour before operation a retrobulbar injection of $\frac{1}{2}$ -1 c.cm. of 4 per cent. novocain was given. The novocain solution contained pituitary extract (1-1½ per cent., pars post.) instead of adrenalin as this is free from the undesirable effects of adrenalin. The novocain solution, as well as the eyedrops, was made up with 1 : 80,000 vuzintoxin (nuvotox) as antiseptic. A drop or two of novocain was injected into the lids at the place where

the lidholding sutures were to be inserted. In practically all cases akinesia was obtained by injecting 1 per cent. novocain into the orbicularis muscle. This prevented the patient from screwing up the eyes. For conjunctival anaesthesia 0.5 per cent. pantocain solution was used. This and 1:1000 adrenalin were dropped into the eye alternately every two minutes, giving 4-5 drops of each. Anaesthesia was excellent, and complete dilatation of the pupil was achieved, and persisted even after the opening of the anterior chamber. In only a few cases was it necessary to instill one or two drops of homatropine to dilate the pupil.

Technique of operation.—The lids were held apart by stitches inserted into them. I preferred stitches to the speculum, as the latter may exert pressure on the eyeball. A stitch was also put into the superior rectus muscle (retraction suture) as this is a very effective means of keeping the eyeball in the desired position. To ensure a good closure of the wound a corneo-scleral stitch was then inserted, as a rule Liégarde's stitch was used. The insertion of this stitch is simplified if a small two-pronged fork is used for fixing the cornea. As will be seen later, closure of the wound by means of a corneo-scleral stitch shortens the time of healing after a cataract operation and reduces the probability of some of the complications. The corneo-scleral stitch is very important as a provision for security of wound closure after cataract operations and it deserves more general recognition.

After the corneo-scleral stitch had been inserted, a corneo-scleral incision with conjunctival flap was made with a Graefe knife. As a rule a peripheral iridectomy was made. Complete iridectomy was performed only in selected cases, *e.g.*, in case of rigid iris with insufficiently dilated pupil, posterior synechiae, pre-existent glaucoma etc. The extraction was then made with forceps by the tumbling method. In most cases Arruga's capsule forceps were used, but if it was impossible to get a grip of the capsule with these forceps, Blaskovics's or Imre's forceps were employed. The lens was loosened by gentle pulling with the forceps and gentle pushing with the squint hook, then dislocated and carefully removed. When the lower edge of the lens was lifted to the lower third of the cornea the forceps were removed and the cataract expressed by a gentle push with a squint hook.

Replacement of the iris followed, but if any complication had arisen during operation the corneo-scleral stitch was first knotted and the iris then replaced. At the end of the operation a drop of 1 per cent. oily eserine and a drop of 25 per cent. argyrol was instilled.

As a result of the novocain injection into the orbicularis muscle the patient was unable to close the eye, so that the upper lid had to be pulled down by the threads of the lid stitch, and these were

fixed to the face of the patient by a strip of adhesive. No dressing with gauze or cotton wool was used. Only a metal shell was fixed over the operated eye by means of adhesive straps. In this way good protection was achieved without any pressure, and the eye was kept shut under the metal shell. The other eye was covered with a pad, fixed by adhesive.

The dressing was changed next day. The lid stitches were removed and a drop of atropine given, and from this day onward the second eye was not dressed.

The operations were performed by the medical staff of the department, some of whom were new to this branch of work.

Generally intracapsular extraction was intended but was not always carried out. In cases where the forceps slipped off, or where the capsule was so tensely stretched as to be incapable of being gripped, capsulotomy was performed with the forceps. Few cases were regarded beforehand as unsuitable for intracapsular operation. For the first few operations beginners performed the extracapsular operation.

Table II gives details of the operated cases.

TABLE II

Method of wound closure	No. of operations	INTRA-CAPSULAR CASES			EXTRA-CAPSULAR CASES		
		No.	Iridectomy		No.	Iridectomy	
			Periph.	Complete		Periph.	Complete
A. Conjunctival flap ...	84	49	28	21	35	12	23
B. Kuhnt's apron ...	109	74	58	16	35	19	16
C. Corneo-scleral stitch...	457	326	256	70	131	81	50

As seen above, in the majority of cases wound closure was secured by means of a corneo-scleral stitch. But the number of cases with the other two methods of wound closure is large enough to enable us to assess their comparative value.

In group A (Table II) the wound and conjunctival flap were made with the Graefe knife and no suture was used (A in Fig. 1). In group B (Table II) a conjunctival apron was first separated after Kuhnt, followed by a corneo-scleral incision with Graefe's knife. After extraction of the cataract the conjunctival apron was pulled down so as to cover the wound. The apron was kept in position by a suture on each side of the limbus (B in Fig. 1). In group C (Table II) a corneo-scleral stitch was used for wound

FIG. 1.

A, flap section; B, Kuhnt's apron; C₁, Liégard's short stitch; C₂, Liégard's long stitch, there is space enough for the conjunctival flap.

closure. In the earlier cases use was made of the shorter corneo-scleral stitch in which the distance between the corneal and scleral points was only two millimetres (C₁ in Fig. 1). Later, however, we adopted the longer corneo-scleral stitch, *i.e.*, with the corneal point located as before but the scleral point rather higher, some five millimetres above the top of the limbus and a little below the superior rectus muscle, since in this way it was possible to leave room for a reasonable conjunctival flap, cut with Graefe's knife (C₂ in Fig. 1).

The corneo-scleral stitch was removed on the 5-7th day, but Stallard's suggestion not to remove it before the 12-14th day is probably better, as by this time wound closure is firmer.

The effect of wound closure on healing after cataract operation may be assessed by the number of days from operation to discharge of the patient from hospital.

Details are given in Fig. 2.

The average number of days the patient was kept in hospital after operation in conjunctival flap cases was 13.36 days, in Kuhnt's apron method 12.32 days, while in cases where corneo-scleral stitch was used it was 11.18.

From this it is clear that the conjunctival flap method demands the longest period of postoperative hospital treatment and the corneo-scleral stitch method the shortest.

Statistical analysis may here be usefully employed to determine whether this observed difference is conditioned by the method of operation, and therefore significant, or whether it is merely fortuitous. In the comparison of Kuhnt's apron group with the conjunctival flap group the probability that the difference of one day is of chance origin, is 0.009, *i.e.*, it would occur in this way nine times in a thousand, while in the comparison of corneo-scleral stitch group with Kuhnt's apron group the probability is 0.000004, *i.e.*, the difference would be of chance origin four times in a million. It may, therefore, be concluded that of these types of wound closure examined, the method employing the corneo-scleral stitch requires the shortest time for healing.

FIG. 2.

Curve showing the duration of hospital treatment with different methods of wound closure. . . . flap; Kuhnt's apron; — corneo-scleral stitch.

The effect of wound closure on the postoperative visual acuity is not so apparent as in all three methods of wound closure the visual acuity was near to 5/10. The exact figures of visual acuity were: conjunctival flap, Mean Vision 0.555; Kuhnt's apron, Mean V. 0.514, and corneo-scleral stitch, Mean V. 0.56. It will be observed that the degree of visual acuity is equally good following conjunctival flap and corneo-scleral stitch wound closure but not quite so good following Kuhnt's apron method. A statistical analysis (*vide* Klein, 1939) has shown that this difference is significant and we may therefore assume that visual acuity tends to be better after conjunctival flap and corneo-scleral stitch operations than after those in which Kuhnt's apron is employed.

Comment.—Conjunctival flap wound closures are followed by very good visual acuity, practically the same as after the employment of a corneo-scleral stitch, but in respect of the duration of hospital treatment they are the least satisfactory. The operation itself is perhaps simpler to perform than the other two, but has the defect that the closure of the wound is entirely dependent on the adhesion of the wound lips to one another and of the conjunctival flap to its basis.

Kuhnt's apron method stands, so far as concerns the requisite hospital treatment, between the conjunctival flap and corneo-scleral

stitch operations. The mean visual acuity is somewhat less than that experienced with the other two methods.

In this operation the conjunctival apron covers the wound and is drawn tightly over it. A bad feature is that during the separation of the conjunctival apron, haemorrhage may occur, which hinders the performance of the operation. Moreover the apron covers the upper part of the cornea, with the result that iris prolapse may occur unobserved. Again when the conjunctiva has retracted to its normal position, it sometimes happens that a small part of it adheres to the cornea, causing pain or discomfort to the patient. A further operation is then necessary in order to remove the attached part of the conjunctiva from the cornea.

It is well known that for rapid and undisturbed healing of the wound the incision should be smooth, and the lips of the wound should be as close together as possible. The latter condition can best be secured by the use of a corneo-scleral stitch, since a stitch that penetrates the cornea and scleral tissues is more effective and resistant than one which binds the loose conjunctiva only. This was confirmed in Hilding's experiments in which he examined the resistance of the wound after different wound-closure methods. The experiments also confirm our clinical experience that the most efficient wound closure is achieved when the corneo-scleral stitch is reinforced by a conjunctival flap, which gives an additional protection.

Complications arising out of cataract operations. Vitreous complication

The term generally used is "prolapse of the vitreous," implying that during or after the cataract extraction vitreous appears in the wound, and some vitreous loss may occur. In this paper, however, not only actual vitreous prolapse and loss, but also all cases where the anterior chamber was reformed during the operation, have been classified as "vitreous complication."

The most common cause of vitreous complication is pressure on the eyeball during operation; this may be exerted by the surgeon or his assistant, or as sometimes happens, by the patient screwing up the eye. On the other hand the trouble may originate within the eyeball itself, for instance when the vitreous has become liquefied and assumed a watery consistency. In such a case it may enter the wound as soon as the incision has been made with Graefe's knife. More often the liquefied vitreous is held back in the vitreous chamber by the zonula lens diaphragm only, and after a typical intracapsular extraction—when this wall has been removed—the anterior chamber suddenly reforms or becomes even deeper than normal and vitreous may enter the wound. This is

common in cases of malignant myopia or longstanding unilateral cataract. Another—though very rare—cause may be that the posterior lens capsule has become attached to the vitreous membrane and some vitreous may be drawn out together with the cataract.

It is probable that there is some connection between the type of cataract and the occurrence of vitreous complication. Greenwood and Grosman have found, in a series of intracapsular operations, that the frequency of vitreous loss was least with immature cataracts (2.8 per cent.), with mature cataracts the frequency increased (8.4 per cent.), a further increase was noticed with hypermature and non-complicated posterior cortical cataracts (about 11 per cent.), and the maximum frequency of vitreous complications was with complicated posterior cortical, traumatic and other types of complicated cataracts (22-25 per cent.).

The question whether vitreous complication is more frequent with intra- or extra-capsular extraction is still open. It appears that the majority of authorities hold the view that it is more frequent with the intra-capsular method. On the other hand reliable operators (Knapp, Fleischer, Passow, Sourdille) have found no difference in the frequency of vitreous complication in the two methods of extraction, while according to others (Gradle, Meesmann) vitreous complication is more frequent with extra-capsular extraction. In my material vitreous complication was slightly more frequent with intra-capsular extraction.

Interesting and instructive are the records of Knapp which give details of the stage of the operation when vitreous loss occurred. Out of 42 cases five occurred after making the incision, twelve during the loosening of the lens, twelve after the delivery of the lens and thirteen towards the end of the operation (return of the pillars of iris coloboma, etc.).

Danger to the eye due to vitreous complication may be attributed to the following factors: damage to the vitreous, infection, and secondary damage caused by adhesions of the iris to the wound.

Minor damage to, or small loss of vitreous has no ill effect on the eye. This is a well known fact in cataract operations, and also in several other operations in which the vitreous may be involved. For instance in posterior sclerotomy a small amount of vitreous is let out. In his anti-glaucoma operation Lindner burns a small hole into the sclera through which he introduces an iris repositor to disintegrate the neighbouring parts of the vitreous. In this case the *vitreous loss* is caused purposely. In case of vitreous floaters zur Nedden has found that after sucking off a little vitreous the floaters absorbed. In the heroic age of the detachment operation the amount of vitreous loss during operation—in consequence of the multiple perforations of the sclera—was

sometimes so large that at the end of the operation the globe was almost collapsed, and yet it was found that the operated eyes recovered.

These examples show that the eye can overcome a certain loss of vitreous, but it would be very difficult to assess the amount of vitreous the loss of which is irreparable.

The second factor is infection, which represents the greatest danger to the eye. In my cases of post-operative infections, however, vitreous complication was not unduly frequent. The chance of infection following extractions with vitreous complication during operation is not greater than that of uncomplicated cases. It seems that if vitreous is incarcerated in the wound, infection may spread into the eye along the vitreous track. With the new methods the wound closure is more perfect, and if the incarcerated vitreous-thread has been cut off and the wound covered with conjunctiva (to keep away the conjunctival bacteria from the wound), infection of the eye is in most cases avoidable.

Damage to the eye caused by adhesion of the iris to the wound : see section Elevation of the Pupil, etc.

In this paper an account is given of 48 cases of vitreous complication (7.4 per cent.). Their frequency among male patients was about three times that of females. It is noteworthy that in about 25 per cent. of the vitreous complications the eyes were myopic. The vitreous complication had no influence on the healing time of the cataract operation; the number of hospital days was about the same as the general average. Vision of the vitreous complicated cases: 5/5-5/15, 33; 5/25-5/50, 10; less than 5/50, 5 cases. In all five cases with less than 5/50, the bad vision was caused by some pre-existing pathological change in the eye (corneal scars, fundus and optic nerve changes). Observation over a long period has shown that vitreous complication during extraction has practically no late effect upon the eye.

Perfect anaesthesia is most important if the vitreous complication is to be avoided—the patient must not feel pain even during the iris excision—as are orbicularis akinesia which prevents the patient from screwing up the lids and the retrobulbar novocain injection which, besides contributing to the completeness of the anaesthesia, lowers the intra-ocular pressure. Other factors are: co-operation of the patient, the administration of sedatives before the operation, avoiding all unnecessary pressure on the globe, and finally, the corneo-scleral suture which enables us to close the wound immediately in case of vitreous complication, thus preventing loss of vitreous if possible. Elschmig suggests filling up the A.C. with air by means of a syringe.

Analysis of these records has shown that vitreous complication has no ill effect on healing after cataract operation and that the

eye suffers practically no damage from it. This view holds true—I think—for most of the cases of vitreous complication except excessive loss of vitreous, a condition which is very rare but presents great danger to the eye.

Contrary to this opinion, many authorities regard vitreous loss as a most serious complication. Let us therefore examine the problem. Normally the vitreous occupies the space behind the zonula-lens wall and we must regard as pathological all cases in which there is a dislocation of the vitreous. During a cataract operation the mildest degree of vitreous dislocation occurs when it enters the A.C. and fills it, partly or completely. The clinical sign of this condition is that the A.C. is suddenly restored during the operation, or becomes even deeper than normal. If the volume of the dislocated vitreous is greater than that of the A.C. it bulges through the incision and part of it may flow out of the eye, resulting in vitreous loss. Sometimes the vitreous gets straight into the wound. The restoration of the A.C. is caused by vitreous flowing into it. If only one additional drop, more than sufficient to fill it, is dislocated, the result is bound to be "loss." But this so-called loss is in fact, as has been shown, precisely the same in nature as the restoration of the A.C.—dislocation of vitreous.

Vitreous disorders may occur not only during or after cataract extraction but also during the needling of juvenile cataracts when the knife penetrates into the vitreous either accidentally or intentionally, and consequently vitreous enters the A.C. The needling of pupillary membrane after cataract operation causes a small hole through which, in the majority of cases, vitreous gets into the A.C. It is interesting to note that authorities who take the most serious view of the vitreous complication during cataract extraction are usually in favour of extra-capsular extraction because vitreous loss with this is supposed to be less probable. But as after this operation needling is frequently necessary, the operator is eventually in a position when some kind of vitreous disturbance cannot be avoided.

It seems that opinions as to the dangers of vitreous complication have passed from book to book for many years unchallenged, whereas the cataract operation as a whole has undergone a thorough revision. The time has certainly come to review the matter in the light of experience with modern methods of operation. Any injury of the vitreous is certainly a complication, and the surgeon should exercise the greatest care to avoid it, but I am firmly of the opinion that the consequences and importance of vitreous complication—except excessive loss—have been exaggerated hitherto.

Prolapse of the iris

Prolapse of the iris occurs when the following conditions are present: (1) re-opening of the wound with sudden overflow of aqueous; (2) the absence of an aperture in the iris (permitting the escape of aqueous from the posterior chamber); (3) increased intra-ocular pressure (Hilding). The increased intra-ocular pressure is the force which re-opens the wound, and the overflowing aqueous pushes the iris into the wound. In the absence of any of these conditions prolapse of the iris should not occur. The probability of re-opening of the wound can thus be diminished if the wound closure is reinforced by corneo-scleral suture; and by iridectomy which provides an outlet for the overflowing aqueous, without pushing forward the iris.

TABLE III

No.	Age	Sex	No. of hospital days	Mode of operation	Mode of iridectomy	Eye and general condition	Vis.	Vitr.	Elev. pupil	Prol. iris	Post-op. inflam.	+ I.O.P.	Hyph.
1	76	M	11	E.C.	Periph.	—	5/35	—	+	+	—	+	+
2	70	F	14	I.C.	P.	—	5/7	—	+	+	—	+	+
3	68	M	15	E.C.	P.	Post cort. cataract	5/5	+	+	—	—	—	—
4	63	M	16	E.C.	P.	Diabetic	5/15	—	+	+	—	+	—
5	68	F	16	I.C.	P.	Myopic eye	5/5	—	+	+	—	—	—
6	60	M	24	E.C.	P.	Old lues	5/10	—	+	+	—	—	+
7	75	F	20	E.C.	Complete	Complete Old glauc. cupped disc	C.F.	—	—	+	—	+	—
8	73	F	20	I.C.	C.	Old glauc.	5/7	—		+	—	+	—
9	61	F	15	I.C.	P.	Asthma. Graves' disease	5/7	—	—	+	—	—	—
10	63	F	28	I.C.	P.	Diabetic	5/5	—	—	+	—	+	—

M Male. F Female. I.C.=intra; E.C.=extracapsular.

1. Late iris prolapse. Cicatrised. I.O.P. normal, a year later cupped, pale discs, V: C.F.

2. Late subconjunctival iris prolapse. After cicatrised. I.O.P. normal

6. Rupture of the wound, followed by iris prolapse accompanied by hyphaema and haemorrhage into the vitreous. Resorption after diathermy heatings and iodine

8. Transitory rise of I.O.P.

10. Transitory rise of I.O.P. Observed for 3 years.

As regards the frequency of iris prolapse after intra- or extracapsular operation opinions are divided.

In this series 18 cases of prolapse of the iris have been recorded (2.8 per cent.). In 14 cases the prolapse occurred within eight days after the extraction, and in four cases a subconjunctival prolapse of the iris appeared later, after weeks or months.

The frequency among male patients was about half of that in females. The relative frequency of the complication after extracapsular operation was more than twice that of the intra-capsular operations, while the type of iridectomy (peripheral or complete) had no effect on it. The healing period after cataract operation was considerably prolonged by prolapse of the iris, the average number of hospital days was 17.2 (min. 9, max. 28), a prolongation of about 25 per cent. over the general average. Vision: 5/5-5/15, 13; 5/25-5/50, 2; less than 5/50, 3 cases. Iris prolapse was associated with other complications in ten cases (Table III).

In one case (No. 3) in which vitreous complication arose during operation, the wound burst on the second day after operation, and iris prolapsed into the wound. Reparative iridectomy was performed immediately: healing time 15 days: vision 5/5. In three cases (Nos. 4, 5, 6), after resection of the incarcerated iris, the pupil became slightly drawn up, and in one of these an increase of the intra-ocular pressure developed. In two cases the iris prolapse was a late complication. In both cases there was a slight haemorrhage into the A.C. during the healing period, and some weeks later a slight elevation of the pupil was observed. Increased intra-ocular pressure, together with subconjunctival prolapse of the iris, developed weeks or months after the operation (Cases 1, 2). The treatment in these cases was resection of the prolapsed iris and excision of the bordering scar (cicatrisesectomy). In two further cases (7, 8), the raised intra-ocular pressure cannot be attributed to the iris prolapse, as the patients had been under treatment for glaucoma before the operation. In both these cases the use of pilocarpine drops was sufficient to keep down the intra-ocular pressure. No. 9 was an asthmatic patient and prolapse occurred during an asthmatic attack. No. 10 diabetic, intra-ocular pressure normal: observed three years.

In prevention of iris prolapse the following points are important. Co-operation of the patient; he must, for instance, observe all instructions, he must be quiet, avoid squeezing the eye during the change of dressing or when eyedrops are put in, and avoid external pressure upon the eye. An iridectomy should be performed so that the aqueous may escape without causing iris prolapse. Perhaps the most important of the preventive measures is the use of the corneo-scleral suture for wound closure. The suture must be symmetrically inserted on the corresponding points of the sclera and cornea, otherwise the adaptation of the wound lips is not satisfactory.

The treatment of iris prolapse belongs to the domain of reparative surgery. In recent cases eserine drops and hot bathing may be tried, but they are usually without effect. In cases where the iris prolapse is covered with conjunctiva some authorities advise postponement of operation for some time, but in this series operation was undertaken without delay in all but the late cases, and the results were good. In this operation perfect anaesthesia is

essential, and for this purpose retrobulbar novocain injection is advisable. In cases where corneo-scleral suture had been employed the operation for prolapse is much simpler and less dangerous, as in most cases the operation can be done without cutting the stitch. First the conjunctiva covering the iris prolapse is freed by means of a blunt instrument, *e.g.*, a canaliculus probe, then the iris is separated from the wound edges and resection of the prolapsed iris performed. The pillars of the iris coloboma are then returned into the A.C. with an iris repositor. The conjunctival flap is then replaced to cover the wound. If there is a gap between the corneo-scleral wound lips, a deep suture may be necessary to secure wound closure. If, together with the iris prolapse, vitreous prolapse occurs, resection of the vitreous prolapse with subsequent diathermy coagulation is recommended (Albrich).

Late subconjunctival iris prolapses are usually preceded by elevation of the pupil, and they develop gradually. The prognosis in these cases is serious.

The importance of iris prolapse is well brought out in the following quotation from Blaskovics (Blaskovics and Kreiker: *Eingriffe am Auge*): "In case of prolapse of the iris and vitreous, immediate operation is necessary only in cases where the corneal flap has been bent over, either outward or inward. Otherwise it is better to wait a few days and to keep the eye bandaged . . . Under complete akinesia the wound is reopened, the prolapsed vitreous resected and the iris returned into the A.C.—or we endeavour to return it. If this is unsuccessful the prolapsed iris has to be resected. The operation is rather difficult, there is constant danger of new vitreous prolapse and collapse of the globe. In most cases there is a haemorrhage into the anterior part of the vitreous; good vision is hardly to be expected. Infection, chronic irido-cyclitis, and detachment of the retina may follow."

In my material the outcome of the iris prolapse cases was not so grave—it may be said it was relatively good—and I feel certain that this may be attributed to the use of the corneo-scleral suture. The value of this suture can easily be appreciated if we consider that the incision of a cataract operation has a length of about 13-15 millimetres. When we use a corneo-scleral stitch, the central part of the wound is firmly held together for a length of 1.5-2 millimetres so that on each side there remains a wound only about six millimetres long. Such a reduction in the length of the wound makes the probability of a complication (reopening or bursting of the wound) much less than the simple arithmetical ratio between the two lengths. The area of an incision 13-15 millimetres long is about six times as large as that of one 5-6 millimetres long, and the danger attendant upon the re-opening of such a large wound is obvious.

Elevation of the pupil and pillars of iris colobomata, and irregular shape of the pupil after cataract extraction

The cause of elevation of the pupil may be incarceration (adhesion) of the zonular fibres in the wound (Kubik), inflammatory changes around the wound (Treberova), or incomplete rupture of the wound, when only the intra-ocular edges of the wound are separated. Elevation of the pupil is relatively frequent after vitreous complicated cataract operations.

This series contains 19 cases of elevation of the pupil or pillars of colobomata (2.9 per cent.), and 17 cases where the shape of the pupil became irregular after cataract extraction. These two groups will be discussed together. The occurrence of this complication was slightly higher with male patients than with females. With extra-capsular extraction the frequency was a little more than with intra-capsular (6 per cent. and 5.35 per cent. respectively). The type of iridectomy was practically without any influence. Visual acuity: 5/5-5/15, 33; 5/25-5/50, 2; less than 5/50, 1 case. In some of these cases, however, increased intra-ocular pressure gradually developed, leading to deterioration or loss of vision (a description appears below).

Study of the cases has shown that we have to distinguish two separate groups. In the first are the cases in which there was vitreous complication during the extraction. This group is marked by the absence of any serious consequences to the eye. Altogether eleven such cases were recorded (eight intra-, three extra-capsular extractions) and in ten cases the eyes remained perfectly quiet, in only one case a "late" complication arose which probably had no connection with the cataract extraction.

CASE 11. Woman, aged 69 years, diabetic. Extra-capsular extraction with peripheral iridectomy. Vision 5/25, remnants of lens matter. A year after the extraction acute irido-cyclitis occurred with raised intra-ocular pressure, and, after settling down, vision was reduced to C.F. 1 metre.

In the second group are those cases in which the cataract extraction was perfectly normal, without any complication, and weeks or months later some disorder developed. Twenty-five cases belong to this group, and in thirteen of them the intra-ocular pressure became raised, this led to a substantial reduction of vision in three cases.

CASE 12. (a) Man, aged 50 years, extra-capsular extraction with peripheral iridectomy. Vision 5/10. Six weeks later acute glaucoma developed, which was preceded by progressive elevation of the pupil. Neither miotics nor repeated operations had any effect. The eye was lost.

CASE 13. (b) Man, aged 64 years, intra-capsular extraction with peripheral iridectomy. Vision 5/10. Two months later attack of glaucoma, cyclodialysis brought the intra-ocular pressure back to normal. The patient did not attend for a year, cupping and paleness of the disc were found and the vision was C.F. 1 metre.

(c) In one case the elevation of the pupil and the raised intra-ocular pressure were associated with late subconjunctival iris prolapse (case No. 1, Table 3).

Among the 13 cases with raised intra-ocular pressure, six were

intra-capsular (1.3 per cent. of all intra-capsular operations), and seven extra-capsular (3.5 per cent. of the extra-capsular operations).

In the remaining twelve patients of this second group the pupil distortion had no ill effect on the eye. Vision and intra-ocular pressure remained unchanged and it was not possible to give any certain explanation for the development of the abnormal pupil. In three cases there was a small haemorrhage in the A.C. during the healing period, which may have been the cause. In the other nine cases the operation, as well as the healing period, was entirely free of complication. I observed one case in which the pupil was perfectly central for twelve months after the extraction and it was not until later that the elevation of the pupil began. This was progressive and eventually the pupil became drawn up completely and looked like a "complete" iridectomy.

If distortion of the pupil is to be avoided it is important that every phase of the operation should be performed with the correct technique. Lens matter, zonular fibres, capsule or vitreous must not get into the wound. If there is vitreous prolapse during the extraction it has to be cut off by means of de Wecker's scissors. The suggestion of Elschnig to fill the A.C. with air as a prophylaxis against elevation of the pupil, is certainly worth trying. In early cases Arndt recommends a simple operation. He introduces a Lang knife into the A.C. near the site of the pupil elevation and as the iris in this stage is only loosely fixed it is possible to separate and return it to its normal position. To assure the central position of the pupil he gives eserine drops for a few days. In some cases it is possible to separate the adhesions between iris and wound by means of cyclodialysis, but we have to employ a somewhat longer spatula than is usually employed. If the pupil disorder is associated with other complications, *e.g.*, raised intra-ocular pressure, the treatment has to be adapted accordingly.

The follow-up study of cases with pupil disorders after cataract operation has shown that they form two well differentiated separate groups. To the first belong cases in which there has been vitreous complication during the extraction. In these cases the pupil disorder has very little significance and causes no harm to the eye. In the second group are the cases of cataract extraction without any disturbing event. This group has a serious prognosis, as in thirteen out of twenty-five cases the post-operative pupil disorder was associated with raised intra-ocular pressure, and in three of them the vision, which was good after operation, became reduced or was entirely lost.

Increase of intra-ocular pressure

The most frequent causes of this complication are: post-operative irido-cyclitis, enclosure of iris tissue or lens capsule in

the wound, and intra-ocular haemorrhage during or after the extraction. Many authorities attach some significance to the vitreous hernia which may bulge into the A.C. through the pupil in case of intra-capsular extraction, or through a hiatus in the posterior capsule in case of extra-capsular extraction. But according to De Saint Martin in a series of 36 cases he found no rise of intra-ocular pressure. The adhesions between vitreous and pupillary margin of the iris are a potential source of post-operative secondary glaucoma (Sinclair).

The method of extraction plays an important rôle, and the opinion is unanimously accepted that the rise of the intra-ocular pressure is far more frequent with extra-capsular extractions than with intra-capsular ones. Gifford describes eleven cases, and all developed after extra-capsular extraction. Fox has found secondary glaucoma in 1.2 per cent. in a series of 1,182 cataract operations, and all occurred after extra-capsular extractions (quoted from Gifford). De Saint Martin had only four cases of secondary glaucoma among 654 intra-capsular extractions.

In the present series of operations, I found twenty cases in which there was a rise of intra-ocular pressure or secondary glaucoma. The average number of hospital days were 13.6 days, which shows that there was little disturbance during the immediate post-operative period, and that raised intra-ocular pressure is a late complication. The frequency among men was about double that of women. Vision at discharge: 5/5-5/15, 14; 5/25-5/50, 4; less than 5/50, 2 cases. In four cases there was a deterioration of vision later.

This series contains five cases in which there was a long standing glaucoma previous to the cataract operation. In eight cases the rise of intra-ocular pressure was transitory, and it was possible to keep it within normal limits by the use of miotics. The intra-ocular pressure became normal after a while and the eyes suffered no damage. In seven cases, however, the raised intra-ocular pressure persisted, and they had to use miotics permanently or, if this was insufficient, it was necessary to perform one or more operations.

Pre-existent glaucoma: five cases. In four of them the intra-ocular pressure was kept normal with miotics; in the fifth acute glaucoma developed and progressed unfavourably.

CASE 14. Man, aged 75 years, had treatment for glaucoma for many years. Extra-capsular extraction with complete iridectomy. Operation and healing without complication, discharged eleven days after operation. The intra-ocular pressure had been kept normal by the use of pilocarpine drops for a year, when glaucomatous attack occurred which would not yield either to conservative or operative treatment.

A transitory rise of intra-ocular pressure was noticed in eight cases and it was necessary to give miotics for a considerable time

(weeks to months) till the eye settled down and the intra-ocular pressure became normal, without any further use of drops. In three cases it occurred after intra-capsular extraction (0.66 per cent.), in all three it was associated with pupil disorders (vision 5/7, 5/7, 5/25). In five cases it developed after extra-capsular extraction (2.5 per cent.); in three of these there was a mild post-operative iritis (vision 5/7 in all three cases), in one case there was iris prolapse (vision 5/15), and in one case no cause was ascertained (vision 5/7).

In the remaining seven cases the raised intra-ocular pressure required permanent treatment with miotics or operation. It may be said that this group alone belongs to the so-called secondary glaucoma after cataract extraction. The distribution between intra- and extra-capsular extraction is two and five cases respectively, which corresponds to a relative frequency of 0.45 per cent. with intra-capsular, and 2.5 per cent. with extra-capsular extractions.

Intra-capsular cases showing raised intra-ocular pressure: (a) It was associated with elevation of the pupil (Case No. 13 p. 106). (b) It was associated with iris prolapse (Case No. 10, Table III).

Extra-capsular cases: (a) After prolapse of the iris (Case No. 1, Table III), (b) and (c) after elevation of the pupil (Case No. 12, p. 106, and Case No. 11, p. 106).

CASE 15. (d) Woman, aged 31 years, traumatic cataract, extra-capsular extraction. Vision 5/7. With constant use of pilocarpine drops the intra-ocular pressure remained normal.

CASE 16. (e) Man, aged 81 years, extra-capsular extraction with complete iridectomy. Much lens matter remained in the eye, and mild post-operative iritis developed. Discharged 20 days after operation. Much vitreous haze was present, and the pupil was slightly elevated. Vision C.F. 3 metres, intra-ocular pressure raised, but miotics kept it normal.

There are no rigid rules in the treatment of secondary glaucoma. If eserine or pilocarpine has no effect, the newer miotics (doryl, mecholy) may be tried. During a glaucomatous attack, intra-venous injection of 50 per cent. glucose or hypertonic saline may reduce the intra-ocular pressure temporarily. After this treatment, the miotics may regain their effect on the eye, or if operation comes into consideration, it can be performed in the favourable period of low or relatively low intra-ocular pressure. The type of operation depends upon the condition of the eye. If, for instance, the secondary glaucoma is associated with subconjunctival iris prolapse it is advisable to perform cicatrisedectomy, *i.e.* excision of the iris prolapse together with the surrounding scar-tissue. But in most cases cyclodialysis will be the operation of choice.

This series of cases shows that the post-operative increase of intra-ocular pressure is a serious complication, and confirms the generally accepted view that secondary glaucoma is far more frequent after extra- than after intra-capsular extraction.

**Post-operative intra-ocular inflammation. Iritis,
irido-cyclitis, kerato-iritis, endophthalmitis**

Post-operative inflammations are responsible for the greatest number of losses after cataract extraction. In this series in about 25 per cent. of the inflammations the eye suffered seriously, and in about 8 per cent. the eyes were lost. Since the fate of the eye often depends upon the outcome of post-operative inflammation, it demands most careful treatment—even in the mildest cases.

Some authorities distinguish between post-operative infection and iritis etc. The clinical appearance may vary from the mildest ciliary flush, through various degrees of uveitis, to endophthalmitis, but from a pathological point of view the distinction between post-operative iritis and infection is certainly not justified. The mildest post-operative iritis may be, and mostly is, caused through infection which enters the eye during operation; on the other hand the severest form of endophthalmitis, even panophthalmitis, may be developed from a focus in the body, *e.g.* cystitis. In this paper therefore *all* post-operative uveal inflammations, without regard to their degree of severity, are dealt with collectively. This is all the more justified as their treatment is based on the same principles. Such a classification, if accepted, would enable us to compare the statistics of different authorities.

Operative trauma as the cause of true post-operative inflammation may be discarded. It may lead to hyperaemia of the iris which disappears in one to three days, and in some cases a drop of atropine is sufficient to dilate the pupil. But the majority of post-operative inflammations are caused by infection during or after the operation, and only in a fraction of the cases can foci or toxins be made responsible for it. The age of the patient has a certain rôle, and Halász has found that the incidence of post-operative inflammation increases with age, with the maximum frequency over the age of eighty.

In the development of this complication the procedure at operation plays an even greater rôle than in the increase of the intra-ocular pressure. The incidence after extra-capsular operation is far more frequent than after intra-capsular. A good explanation may be that the lens matter which has been left in the eye after extra-capsular extraction, is a very good nutritive medium for bacteria which may enter. Opinions are divided as regards the anaphylactic inflammation caused by lens matter.

Intra-capsular extraction as a prophylactic against post-operative inflammation is stressed in Meller's warning, who—though on the whole in favour of extra-capsular extraction—points out that post-operative inflammations are not so common after intra-capsular extraction. He advises therefore the intra-capsular extraction for cataract patients who have a stubborn conjunctivitis, resisting every kind of treatment.

It is very difficult to ascertain the causes of post-operative inflammation. Factors which might have some significance in post-operative inflammation were found in this series of cases: about 25 per cent. of the cases were diabetic (9 cases), and two patients had syphilis. Both these conditions reduce the patient's resistance towards infection. In some cases infected foci may act as a potential source of the inflammation. Cystitis was probably the cause in one case. The condition of the teeth does not seem to have much influence. In the majority of the patients the teeth were in a most unsatisfactory state and yet where there was post-operative inflammation, other causes than the teeth were more probable.

Local conditions which favoured the onset of infection were: rodent ulcer of the face in one case; after irrigation of the anterior chamber mild iritis developed in six cases which all reacted well to atropine drops, and if necessary, milk injection; in three cases it was found that inflammation developed after operations during which instruments were introduced into the eye many times—for instance in attempting to remove the capsule after extra-capsular extraction had been performed.

Forty cases of post-operative inflammations (6·2 per cent.) are recorded here. The average age of the patients was 67 years. The effect on the healing time was significant as shown by the number of hospital days. The average was 18·5 days, which is the longest healing time in all post-operative complications. The frequency of the incidence with intra-capsular operation was 2·6 per cent. and with extra-capsular 14 per cent., that is a ratio of more than one to five. And in cases of the most serious inflammations the ratio was one to eight. Vision: 5/5-5/15, 26; 5/25-5/50, 3; less than 5/50, 8; no P.L., 3 cases.

As has been said post-operative inflammation has the most serious consequences of all the complications, and as we learn most from our failures I give the following details.

CASE 17. (a) Woman aged 84 years, intra-capsular extraction with complete iridectomy. On the second day after extraction plastic iritis developed. For three days atropine, milk injection and large doses of salicylates were tried without much effect, then keratotomy brought the process to a standstill. The patient was dismissed 32 days after operation. The eye was white, perception and projection of light was good. In the pupillary area there was a thick membrane. The patient was told to come back for needling after some months, as the probability of useful vision after needling was good. She did not return.

CASE 18. (b) Man, aged 71 years. On the other side of the face there was a rodent ulcer, for which the patient refused operation. Before operation it was cleaned up as much as possible, and treated with disinfectants. The cataract extraction was intra-capsular, with complete iridectomy. Three days later some exudate appeared in the A.C. The inflammation settled down in 28 days, after vigorous treatment with salicylates and foreign protein. Vision C.F. 1 metre, much vitreous haze.

CASE 19. (c) Man, aged 50 years, extra-capsular extraction with complete iridectomy. Vitreous complicated extraction. On the third day symptoms of endophthalmitis appeared. After atropine, foreign protein treatment and keratotomy,

the inflammation settled down in 18 days. Vision C.F. 1 metre. The patient had cystitis.

There were in this series two tragic cases in which both eyes had severe post-operative inflammation.

CASES 20-21. (d)-(e) Man, aged 80 years, extra-capsular extraction with complete iridectomy. The healing was undisturbed so on the eighth day after operation the cataract of the second eye was operated upon. This was also extra-capsular with complete iridectomy. Two days later, *i.e.*, ten days after the first operation, there were symptoms of mild iritis in the first eye. A few days later the second eye was inflamed too, and in spite of all treatment the uveitis dragged on. It was interesting that apart from some haziness the aqueous was relatively clear. The iris was hyperaemic, thick and oedematous. Eventually, both eyes showed a clinical picture which was very similar to conglomerate tuberculous iritis. It took 75 days before the eyes settled down and the patient was able to leave the hospital. Phthisis of the globe developed in one eye which later had to be excised. Prof. Löwenstein (Staatl. Serotherap. Institut, Vienna) grew *B. Tuberculosis* from the globe. In the second eye vision was C.F. 1 m.

CASE 22-23. (f)-(g) The second patient was a woman, aged 62 years. The operation on the first eye was performed in 1935, extra-capsular extraction with complete iridectomy. The operation was a typical one without any complication. On the seventh day iritis appeared and gradually a deep keratitis set in. The eye settled down in eight weeks, and the cornea cleared up considerably. Vision 5/50. Six months later a new attack of iritis developed which ended in phthisis bulbi. The second eye was operated on in 1937. On the fifth day iritis developed the course of which was very similar to that of the first eye. In this eye, luckily, no phthisis of the eye developed. Dense corneal scars remained and vision was hand movements, perception and projection of light was good.

The post-operative inflammation of the second eye was unexpected as the patient was overhauled very carefully before the operation, with special attention to the existence of potential foci of infection. The pre-operative treatment, as well as the operation, was even more cautiously made than in routine cases. It is noteworthy that the post-operative inflammation of the two eyes was very similar in symptoms and outcome. Both eyes showed a deep keratitis which in itself is not frequently met with after cataract extraction. Another feature was the relatively late appearance of the inflammation—in one eye seven days, in the other five days after the operation. It is possible that this is one of those which have a tendency to post-operative inflammation, perhaps as the effect of some constitutional disorder.

CASE 24. (h) Woman, aged 49 years. Tumescant cataract which caused glaucomatous attack. The eye responded well to miotics, and the cataract operation was performed at a time when the intra-ocular pressure was practically normal. The A.C. was very shallow, and routine extra-capsular extraction with complete iridectomy was performed. Post-operative uveitis with deep keratitis developed, and in 16 days the eye settled down. Vision C.F. 1 m.

(i) See Case No. 16 p. 109.

CASE 25. (k) Woman, aged 71 years, diabetic. Extra-capsular extraction with peripheral iridectomy. Four days later mild ciliary injection developed which settled down in a few days. The patient was dismissed ten days after the operation. Subsequently a chronic, mild cyclitis was recorded; slight pains chiefly at night, but the eye was white and only slit-lamp examination showed some haze in the aqueous and a few active K.P. Treatment had practically no effect and six months later vision was C.F. 1 m., and intra-ocular pressure was very low.

In the following case, the post-operative inflammation did not cause any loss of vision as long as the general condition of the

patient was satisfactory, but the follow-up of this case has shown some interesting features.

CASE 26. (l) Man, aged 80 years, extra-capsular extraction with peripheral iridectomy. On the ninth day after operation the eye was somewhat painful, next day iritis developed which settled down in a further ten days. The patient received ultra short wave treatment and tophosanyl injections (atophan preparation). Vision 5/7. Two months later recurrence of the iritis took place, and at the same time painful swelling of both shoulders, and of elbow and wrist on one side. Aqueous was hazy and vision dropped to 5/50. In six days the iritis healed and vision was restored to 5/7. After another six weeks I was asked to see the patient who was seriously ill. The vision of the eye was lost. But this time, not iritis, but extensive retinal oedema of both eyes was responsible for the loss of vision. The patient had cardiac breakdown and a few days later he died.

In this case the post-operative iritis developed on the ninth day, and up to that time the healing was undisturbed. This points against an infection, and it seems probable that the two attacks of iritis and the painful swelling of joints were of the same origin.

Another question which arises here is how far the operation upon the eye was responsible for the deterioration of the general condition of the patient. Any operation at this age has its dangers, and before deciding upon a cataract operation, not only the eye but the possible effect on the general condition, should be taken into consideration. Harrison Butler pointed out in connection with glaucoma operations that sometimes the operation may be successful as regards the eye itself but the general condition of the patient suffers.

In this series of cataract operations there was no case of panophthalmitis.

Prophylaxis and Treatment.—The majority of post-operative inflammations are caused by infection, therefore asepsis must be strictly adhered to. It is also important that the operation should be performed gently and carefully so as to give rise to as little operative trauma as possible. Further, we have to consider the general condition of the patient, to make him as fit as possible before the operation, and to eliminate known infective foci. Finally, we have to bear in mind that post-operative inflammation is more frequent after extra-capsular operation, therefore, wherever possible the intra-capsular operation should be done.

For local treatment mydriatics (atropine, hyoscine, cocaine) and heat are employed. If local treatment is insufficient we must use other methods. In cases of persistent ciliary tenderness and pain during night, ultra short wave treatment has a good effect. But in severe cases ultra short wave irradiation is only a supplementary treatment, supporting other therapeutic measures, such as foreign protein therapy (milk, T.A.B. vaccine etc.), large doses of sodium salicylate may be used, sulphanilamide preparations, urotropine, atophan, etc.

Early and vigorous treatment is essential, but this alone in severe cases is not sufficient, and keratotomy together with cauterisation

of the lips of the wound may be useful. This operation is advisable in the severe forms of post-operative endophthalmitis, and suppurative uveitis where the A.C. contains much exudate. In these desperate cases a simple keratotomy would have practically no effect, as the A.C. fills with exudate again in a few hours. If the cautery is used, the A.C. will be drained for many days and the operation is easy to perform. Keratotomy is done in the lower part of the cornea, and after letting out the aqueous and exudate from the A.C., a Daviel spoon is inserted into the wound so as to protect the iris and the posterior wound lip. Then a small hole is burnt into the anterior wound lip of the cornea with a fine pointed galvano-cautery.

The resulting scar is very small, and is outside the pupillary area, so that it will not interfere with vision. In some of these cases where there was no response to other treatment and the condition of the eye showed steady deterioration, I had satisfactory results from this operation. In three cases the endophthalmitis stopped after the operation, and in one of them, where needling was performed later, the vision achieved was 5/10.

Strictly, thread infections spreading along the corneo-scleral stitch do not belong to the group dealt with in this section, but as they are infections it seems reasonable to include them here. In a series of 457 corneo-scleral stitches, only two infections were recorded. In both cases the stitch was removed as soon as the infection showed itself, and the small infiltrate of the conjunctiva disappeared in a few days. If necessary, the infiltrate may be touched with a fine pointed galvano-cautery.

Other complications

In two cases *retrobulbar neuritis* was recorded about a month after extraction.

CASE 27. (a) Woman, aged 66 years, long standing chronic benign glaucoma. extra-capsular extraction with complete iridectomy. Operation and healing were undisturbed, and the patient was discharged twelve days after operation. Vision 5/10. Five weeks later the patient complained of sudden loss of vision. Intra-ocular pressure was normal and no change in the retina or refractive media was found, but there was a large central scotoma. After administration of vitamins, amyl nitrite inhalation, and strychnine the vision was again 5/10 in 14 days. She was under observation for three years, the vision remained unchanged although the disc became pale.

CASE 28. (b) Man aged 78 years, intra-capsular extraction with peripheral iridectomy. Operation and healing undisturbed, except a minor degree of choroidal detachment which became reattached in 14 days. Vision 5/15 which was due to senile changes in the macula lutea. Four weeks later the patient noticed blurring of vision. There was no change in the fundus, but a large central scotoma was found. The patient received vitamins, acetyl-choline-chloride hypodermic injections, and local heat by means of diathermy. The vision was gradually restored to 5/15. The patient was observed for a year, vision was unchanged, but pallor of the disc developed.

The rhinological and neurological findings in both cases were negative.

Hyphaema.—All haemorrhages—even if only a trace—which appear during the healing period after cataract extraction belong to this group. The commonest cause of hyphaema is the reopening or rupture of the wound. In many cases only the interior wound edges are reopened and the wound is apparently undamaged. On the other hand haemorrhages may occur from blood vessels severed during the iridectomy, or from new capillaries growing into the wound.

The incidence of hyphaema after corneo-scleral stitch operations was double that observed after other methods of wound closure (20 per cent. resp. 10 per cent.). The majority of hyphaemas occurred 5-7 days after operation, and this was the time when the corneo-scleral stitch was usually removed.

TABLE IV

Days after operation	...	1-2	3-4	5-6	7-8	9-10	11-12	13-14
Haemorrhage in the A.C. in per cent.	...	15	17.5	26	24.5	12	3.5	1.5

Stallard found hyphaema in about 30-35 per cent. after cataract operations where no corneo-scleral stitch was used, whereas with the use of it, the incidence dropped practically to nil—in 107 consecutive cataract operations no post-operative hyphaema occurred. Stallard removed the stitch after 10-12 days, *i.e.*, after firm closure of the wound, and this may be the explanation of his good results. Recently, however, Ellett and others have found that the use of a corneo-scleral stitch had not fulfilled the hopes as regards post-operative hyphaema.

Most of the haemorrhages occurred into the A.C., and only in very few cases was vitreous haemorrhage associated with it. The prognosis of the hyphaema is generally good, and as a rule they clear up in a few days without any treatment. In rare cases, however, where absorption is slow or there is much blood in the A.C., keratotomy may be valuable. The absorption of vitreous haemorrhages takes a longer time, and it may be imperfect and vitreous floaters remain. This may cause permanent damage to vision. In this series one such case was recorded. There were some others where the vision was 5/5, yet vitreous floaters, probably through diffusion of light, caused the patient discomfort. Vitreous haemorrhage—contrary to haemorrhage in the A.C.—needs treatment, the aim of which is to accelerate its absorption. I have found that the combination of diathermy heating of the eye and large doses of iodine often give a good result. I have also tried vitamin C without any benefit to the patient.

Comment and Summary

In the *first part* of this paper, statistical analysis of the *whole mass* of operations has shown that the method of wound closure has a significant influence upon the duration of the healing period. Experience with three different methods of wound closure—all widely used—has clearly proved that the shortest healing time follows the use of a corneo-scleral stitch. The difference in the time of healing between the conjunctival flap and Kuhnt's apron, and between Kuhnt's apron and corneo-scleral stitch operations, is about 10 per cent. From this it can be seen that a considerable saving in nursing expense may be effected and that the patient can return to normal life earlier.

The corneo-scleral stitch is valuable where circumstances require rapid closing of the wound, as for example in cases of any complication during operation. Besides this the stitch gives protection against the reopening or rupture of the wound, and should a wound rupture take place the consequences are milder.

In the *second part* of this paper an account is given of *each individual case* in which complication occurred during or after the extraction. Analysis has shown that:

After vitreous complicated extractions the damage suffered by the eye was slight. This generalisation, of course, is not valid in case of excessive loss of vitreous.

The incidence of prolapse of the iris and of the pillars of iris colobomata after extra-capsular extraction was about twice that following intra-capsular extraction. The treatment of prolapse of the iris should be immediate reparative operation, in which case the prognosis is relatively good. Subconjunctival iris prolapses, which develop weeks or months after the extraction, are serious, and treatment consists in excision of the prolapse and adjoining scar tissue.

Elevation of the pupil or of the pillars of colobomata or irregularity in the shape of the pupil, after vitreous complicated cataract extractions, causes no damage to the eye, while in those cases which occur after uncomplicated extractions, the pupil disorder was followed by increase of intra-ocular pressure in about half the cases.

Among the serious cases of secondary glaucoma following extra- and intra-capsular extraction the ratio was five to one.

In desperate cases of post-operative inflammation the ratio in favour of intra-capsular extraction was eight to one.

Secondary glaucoma and post-operative inflammation take the heaviest toll after cataract extraction, and the best means of avoiding them seems to be to employ intra-capsular extraction. Although the reputation of this operation is steadily increasing there

are many who favour the extra-capsular method. It is true that the latter is somewhat easier to perform, but the intra-capsular extraction is not a difficult matter for an experienced operator. It has often been stated that with intra-capsular extraction vitreous complications are more frequent. But, even if it were so, since vitreous complications are so much less serious than was formerly believed this argument loses much of its validity. Moreover, as stated above, there is a considerable divergence of opinion on this question.

Another weakness of the extra-capsular method is that a second, and sometimes a third, operation may be necessary. Davenport gives account of 2,368 extra-capsular extractions, and in 1,479 cases needling had to be performed. Apart from the difficulties and discomfort of a second operation, it must be remembered that needling is not free from dangers and complications, and even losses may occur after it.

All the above considerations point to the value of reinforced wound closure by means of a deep suture, and to the superiority of the intra-capsular method. Improvement in the technique of the intra-capsular extraction has made it applicable to all but a very limited number of cases, and full use should be made of it.

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