

CATARACT SURGERY

AN ANALYSIS OF ONE HUNDRED CASES

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Every year in the Ophthalmic Department of the Singapore General Hospital, about 700 lenses are removed from the eyes of adult patients blinded by cataract. And every year over 600 patients whose vision was too poor for industrial and other purposes had their sight restored to normal or almost normal. This paper discusses the recent advances in cataract surgery and analysis of 100 cases recently done by the author.

Indications for Operation

The most important indication is the relationship of the visual acuity to the occupation of the patient. In bilateral cases, if the visual acuity of both eyes is diminished enough to interfere with the normal work of a patient, the removal of the lenses is indicated. However, if the visual acuity is better than 6/18, the surgeon should hesitate to remove them as aphakic eyes have their inherent disadvantages.

Unilateral cataracts are best left untreated, but removal may be considered when the cataract is hypermature, and when an increase field of vision is required or for cosmetic reasons. With recent advances of contact lenses and intraocular acrylic lens implants, the possibility of providing binocular single vision to a patient should always be considered.

The analysis of 100 cases (Table I) show that by far the commonest indication was visual defect.

Indications	cases	%
Visual defect	95	95%
Hypermaturity	4	4%
Increase field of vision	1	1%
Binocular vision	—	—
Cosmetic	—	—

TABLE I. INDICATIONS FOR CATARACT EXTRACTION.

Historical Background

Couching was probably done amongst the Egyptians, Romans and Arabians over 400 years ago. It is a neat operation but the subluxated lens will almost always cause a lens-induced uveitis, resulting in the destruction of the eye.

In 1745, Daniel introduced the method of cataract extraction which has remained fundamentally the same to-day. He used a keratome section which was enlarged with scissors. He then ruptured the capsule with a needle and extracted the lens extracapsularly by external pressure. A hundred years later von Graefe invented his knife which is still used to-day.

Little advancement was made until the late 19th century, when Colonel H. Smith of the Indian Medical Service introduced intracapsular extraction by expression. This was not met with good results by European Surgeons probably because of the stronger European zonules. Then the use of the intracapsular forceps and the eriosphake by suction was introduced in the early 20th century. The combination of this with expression and the introduction of facial akinesia by von Lint and retrobulbar anaesthesia by Eischnig were landmarks of great improvements in cataract surgery.

After the 2nd world war, in 1949, Arruga introduced the corneo-scleral stitch which not only lowered the incidence of hyphaema, but also the degree of post-operative-astigmatism. The introduction of intraocular acrylic lens implants and alpha-chymotrypsin were the climax of the great advance of cataract surgery so that visual improvement after surgery should be almost 100%.

Anaesthesia, Akinesia and Sedation

There is a growing popularity for lenses to be extracted under general anaesthesia. It has a definite advantage of relieving the surgeon of the anxiety of whether he has given adequate anaesthesia and akinesia.

In this series, all the cases were done under local anaesthesia, akinesia and sedation. Sedation was achieved by oral largactil 25 mgm. and phenergen 50 mgm. 1½ hours pre-operatively

and a varying amount of intravenous pethidine just before operation. Akinesia of the 7th. cranial nerve was done by local injection of 2% lignocaine in adrenaline by either the O'Brien and/or von-Lint method. Retrobulbar injection of 1-2 cc. of 2% lignocaine in adrenaline and local drops of 1% amethocaine were given routinely.

The importance of properly administered akinesia, anaesthesia and sedation cannot be over emphasised. The prevention of complications of cataract surgery is largely dependent on how adequately they work during operation. The surgeon should administer these himself; the doses and techniques varying from individual to individual. Furthermore, he should not proceed with the operation until he is satisfied that they are working effectively.

Technique of Operation

Innumerable techniques are described and each surgeon claims that his is superior. The important fact remains that while each surgeon should develop his own technique, he must accept and follow certain fundamental principles, such as proper sedation, akinesia and anaesthesia, good section, an iridectomy or its equivalent, careful choice of method of extraction, good wound closure and aseptis.

The method (Table II) used in this series was as follows:—

- (1). The lids were retracted with nylon sutures.
- (2). A superior rectus bridle suture was inserted.
- (3). A triangular conjunctival flap was made and the corneo-scleral region exposed.
- (4). A preplaced suture was inserted.
- (5). A limbs section was made, generally with von Graefe's knife and occasionally with the keratome and scissors.
- (6). Iridectomy or iridotomy was done.
- (7). The extraction was usually intracapsular. This was usually done with forceps although the erisophake was also used (Table III). Alpha-chymotrypsin was used for patients under 50 years old.

When indicated, extracapsular extraction was done.

- (8). The wound was examined and closed.
- (9). The conjunctival flap was sutured.

- (10). Air was injected into the anterior chamber.

Section	Knife 94	Keratome 6
Iris	Iridotomy 58	Iridectomy 42:— a). Peripheral 31 b). Complete 11
Extraction	Intracapsular 75	Extracapsular 25

TABLE II. VARIATIONS OF OPERATIVE TECHNIQUE.

Without alpha-chymotrypsin	73	} 75
With alpha-chymotrypsin	2	
With forceps	64	} 75
With erisophake	11	

TABLE III. VARIATIONS OF TECHNIQUE OF INTRACAPSULAR EXTRACTION.

The use of nylon sutures to retract lids is a method now generally accepted and the author has no doubts that its use is superior to the use of a speculum.

The superior rectus bridle suture to rotate and fix the eyeball in a slightly inferior position is another step in the technique of cataract surgery which is universally used.

The use of a conjunctival flap helps to improve the rate of wound healing. However, while some surgeons will have a complete conjunctival flap covering the whole of the corneo-scleral section, thus making it almost impossible for the epithelisation of the anterior chamber to occur, other surgeons routinely make their sections without any conjunctival flap. The author prefers a small triangular flap.

There is great controversy regarding the number and type of sutures used. On one hand some surgeons do not use a suture at all while others use as many as seven sutures. It is the author's opinion that a preplaced corneo-scleral suture can be most accurately placed and that this is an extremely important factor for proper wound healing. The author uses one suture routinely, but in selected cases uses two or more sutures.

A section can be made either with a knife or with a keratome. Each has its own advantages. The use of a knife is more difficult a technique to master, but a neatly performed knife section

is the ideal wound. Some surgeons make a small knife section and enlarge it with scissors. Whenever scissors are used, it is important that the blades are sharp to avoid a crushing effect on the edges of the wound. Of the 100 cases, von Graefe's knife was used in 94 cases.

After the section, an iridotomy or peripheral iridectomy is made to preserve a round pupil. A full iridectomy is done in selected cases especially when difficulty is expected during the lens extraction. It makes the operation easier but is cosmetically less attractive and vision perhaps not just as good.

Whether the lens is extracted by the intracapsular or extracapsular method, depends on a number of factors. The author uses the intracapsular method routinely. However, he considers the use of extracapsular method of extraction in cases of mature cataract and also in cases where he believes the capsule is thin and may rupture during extraction by the intracapsular method, such as in a case of a brown cataract. The use of an erisophake in intracapsular extraction is particularly useful when the lens is intumescent and difficult to grasp with an intracapsular forceps.

Alpha-chymotrypsin is often used for younger patients below the age of 60 years. It is the opinion of the author that the zonules of the local population after the age of 50 years are usually sufficiently weak to be removed without difficulty and alpha-chymotrypsin was only used in 2 patients who were below the age of 50 years.

After the extraction of the lens it is extremely important to examine the wound and assure that there are no tags of capsule, lens matter, and particularly little tags of conjunctiva in the wound as the latter can cause the very serious complication of epithelisation of the anterior chamber.

The suturing of the conjunctival flap prevents the flap being displaced after operation and should be done routinely. The injection of air into the anterior chamber replaces the space formerly occupied by the lens and thus maintains the shape of the eyeball. However, air glaucoma has been described as a serious complication, but is extremely rare and the author has not seen such a case.

Visual Results

The visual results make cataract extraction a very gratifying operation. 84% of this series had normal vision restored (Table IV). Of the 16% with subnormal vision, 11% was due to some other ocular disease (Table V). Thus, if poor visual results due to other ocular diseases are eliminated the percentage of normal vision after operation is 94.3%.

In the 5 cases where the visual acuity was subnormal, and as no other ocular disease was found, the cause of the defective vision might be attributed to difficulties encountered during the operation and the post-operative period. 3 cases had industrial vision (i.e. 6/12 partly and better) and were due to a high degree of corneal astigmatism which was caused by iris prolapse and wound gapping: although all three patients were uncooperative during the post-operative period, these complications might have been minimised by inserting more corneo-scleral stitches. One case was due to the detachment of retina which might be associated with loss of vitreous during operation. Another case was due to intractable corneal oedema associated with vitreous herniation into the anterior chamber. However, in the 4 cases the visual acuity was better than it was before operation. In the case with detachment of retina, the patient refused operation and the eye finally became blind.

Visual acuity	6/9 and better (Normal Vision)	6/12 - 6/24	Worse than 6/24
	84%	10%	6%

TABLE IV. VISUAL RESULTS.

Causes	6/12 - 6/24	Worse than 6/24
Glaucoma	1	1
Retinal disease		
Diabetic	2	1
Hypertension	1	—
Myopic degeneration	1	1
Detachment	—	—
Cloudy media	1	1
Optic Atrophy	—	1
TOTAL	6	5

TABLE V. CAUSES OF DEFECTIVE VISION DUE TO OTHER OCULAR DISEASES.

Astigmatism

Degree of Astigmatism	< 3D	3 - 6D	> 6D
	79%	19%	2%

TABLE VI. DEGREE OF POST-OPERATIVE ASTIGMATISM.

Astigmatism against the rule was almost always present as a result of the wound and 79% of astigmatism was below 3 dioptres, (Table VI), while the average astigmatic error was about 2.2 dioptres against the rule.

There were only 2 cases of astigmatism above 6 dioptres and they were due to post-operative prolapse iris in one case and post-operative gapping of the wound in the other.

It is generally agreed that with better wound healing astigmatism may be minimised and this may be achieved with more corneo-scleral sutures.

Recent Advances

Recent progress in cataract surgery is largely associated with the introduction of alpha-chymotrypsin for intracapsular extractions, the use of contact lenses and intraocular implants and better anaesthesia and instruments.

Alpha-chymotrypsin

In younger patients below the age of 60, the major problem is that the zonules are generally strong and intracapsular extraction becomes difficult and dangerous.

In June, 1957, Barraquer of Barcelona, Spain, accidentally found that alpha-chymotrypsin, an enzyme, almost specifically weakens the zonules without severe damage to the other structures of the eye.

The use of alpha-chymotrypsin, 1:5,000 has recently been shown to be of great value in the lysis of the zonules of patients between the ages of 20-60 years.

Below the age of 20 years the ligamentum hyaloideocapsulare is strongly adherent to the posterior surface of the lens and intracapsular extraction is dangerous even with the use of alpha-chymotrypsin. Above the age of 60 years the zonules are usually weak and the use of the enzyme is generally unnecessary. However, the zonules of Asians appear to be weaker and the author seldom experienced difficulty with intracapsular extractions without alpha-chymotrypsin in patients over the age of 50 years. However, more experience with the use of the enzyme is required before a definite conclusion can be made.

Recent survey of cataract surgery in the United Kingdom by Zorab showed that about 30% of the surgeons in the country used the enzyme routinely for their intracapsular cataract extractions and about 20% used it in selected cases.

There were many complications described associated with the use of alpha-chymotrypsin. However, there was only one common complication which was generally agreed to have occurred due to its use. This complication was delayed wound healing. Delayed wound healing gave rise to delayed formation of the anterior chamber, anterior peripheral synechia with

glaucoma, rupture of the corneo-scleral wound, iris prolapse, and the late loss of the anterior chamber. This complication was found by Barraquer in Barcelona, Spain, to be the only significant complication after having performed 757 intracapsular lens with the aid of alpha-chymotrypsin.

Other complications described included corneal oedema, striate keratitis, increase vitreous loss and increase frequency of post-operative oedema, increase pigment dispersion into the anterior chamber, greater post-operative inflammation, hyloid rupture, secondary glaucoma, retinal detachments and retinitis.

There are however, more convincing reports, that with a concentration of 1:5,000 other complications besides defective wound healing are negligible.

A recent report of 2 eyes of patients studied 5 or 6 days after operation of patients who have died from other diseases have shown that there were no other changes in the eye except the break in the zonule. The same author stated that alpha-chymotrypsin can act only in the presence of benzyl and para-hydrobenzyl radicle, and that these radicles are only contained in phenyl-alanine and tyrosine. It was found that zonular fibres contain tyrosine and it is possible that this substance acts as a substrate for enzyme action, and it may be that the presence of this tyrosine will explain the reason why alpha-chymotrypsin acts specifically on the zonule.

There are several ways by which one can minimise delayed wound healing in these cases.

1. The incision should be made at the sclera rather than the limbus, because the former is more vascular.
2. The use of a conjunctival flap.
3. Careful suturing.
4. The enzyme should be removed as soon as possible, especially from the incisional area.
5. Avoid damage to wound edges.

In this series, alpha-chymotrypsin was used in only two cases. There were no complications. The author believes that it should be used in intracapsular extraction for patients between the ages of 20 to 50 years. Its use in patients over the age of 50 is still controversial, however the author considers that it should be used in selected cases.

Unilateral Aphakia

After the extraction of a cataract the optical system of the eye loses its lens which is responsible for a convergent power of about 20 dioptries. Thus the image formed is brought to focus some distance behind the retina and is blurred. A clear image can be formed by placing a strong convex glass of about 10 dioptries anterior to the aphakic eye. However, the image formed becomes 30% larger than that of the phakic eye and diplopia results.

The above problem is partly overcome by the use of a contact lens which reduces the image size to an increase of about 8%; a difference often tolerated. More recently, H. Ridley introduced the introcular acrylic lens implants which allow an image of almost the same size to be formed on the retinae of both eyes. For a time this was thought to be the solution to the problem of unilateral aphakia. Unfortunately, the introduction of foreign material into the eye sometimes causes dangerous complications and its use as a routine has to be carefully reviewed.

The Ridley lens implant, which is placed behind the iris, required an extracapsular extraction and was often complicated by dangerous complications such as posterior dislocation of the lens. Its use is not generally recommended.

The more recent development of an anterior chamber acrylic lens implants have been more successful. Many types and patterns have been made although they all have the common feature of a small lenticular part which is centred over the pupil by supports. They are all relatively easy to insert, and they cannot be dislocated. However, they can cause a major complication of corneal oedema associated with endothelial damage. This complication was found to be particularly common when rigid supports were used but recent introduction of flexible supports have reduced its incidence.

The achievement of binocular single vision in unilateral aphakia after intraocular acrylic lens implants was different in several recent reports, varying from 10-80% successes.

The author considers that intraocular acrylic lens implants have come to stay as a major advancement in cataract surgery. Their use should however, be limited largely to carefully selected cases of unilateral aphakia.

Anaesthesia and Instruments

The discovery of drugs with less tendency to cause post-operative vomiting and the improvement of anaesthetic technique have made gene-

TECHNIQUE OF EXTRACAPSULAR EXTRACTION OF CATARACT.



Fig. 1. Upper lid stitch.

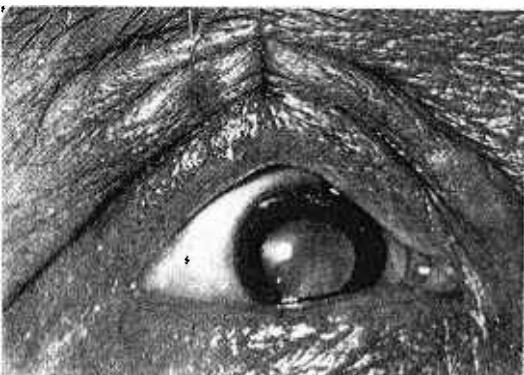


Fig. 2. Upper lid retracted to expose eyeball.

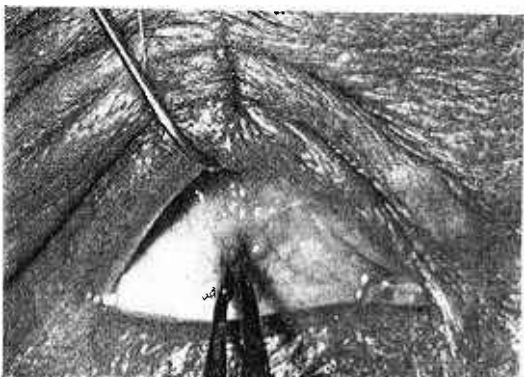


Fig. 3. Superior rectus tendon grasped with forceps.



Fig. 4. Superior rectus bridge stitch inserted, fixing eye in depressed position.

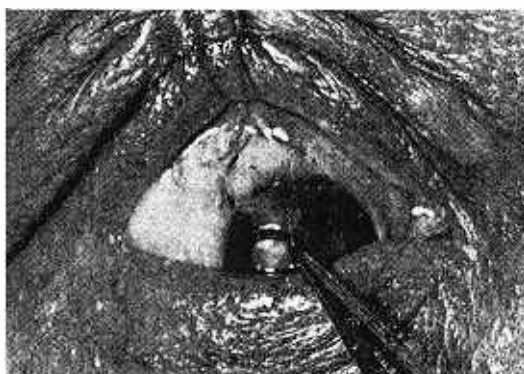


Fig. 5. Small conjunctival flap made.



Fig. 6. Preplaced corneo-scleral stitch inserted.

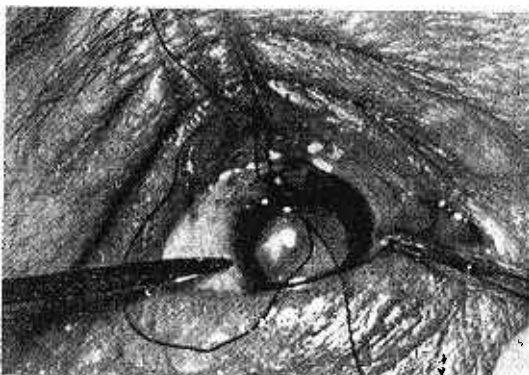


Fig. 7. Von-Graefe Knife inserted temporarily just external to limbus at 9 o'clock.



Fig. 8. Knife inserted into anterior chamber, while eye is fixed with fixation forceps.

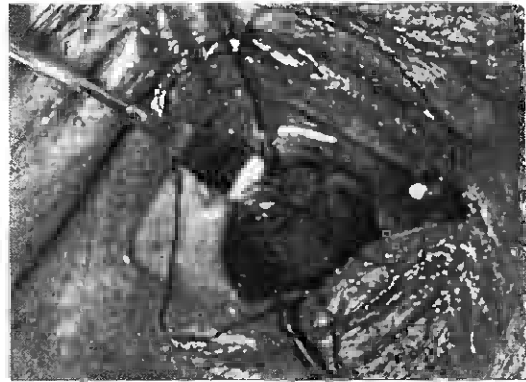


Fig. 12. The nucleus being removed by counterpressure with squint hook and spoon.

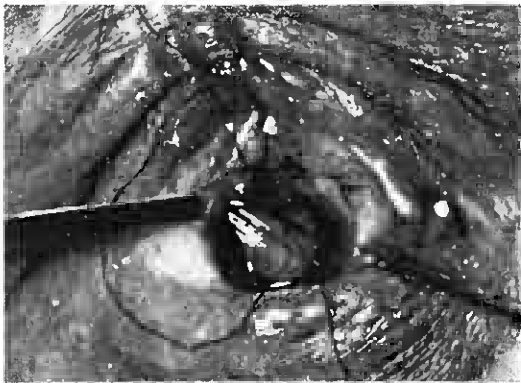


Fig. 9. The knife section being completed.

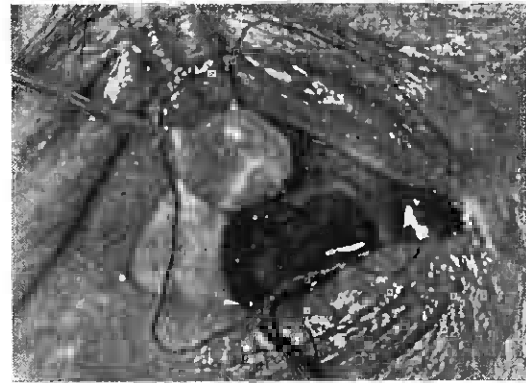


Fig. 13. The nucleus removed by spoon.



Fig. 10. Iridotomy.

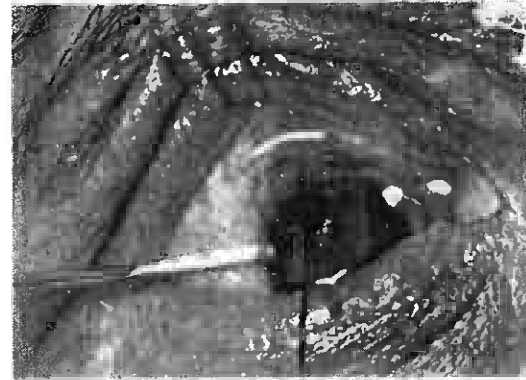


Fig. 14. The remnants of the lens washed out with saline.

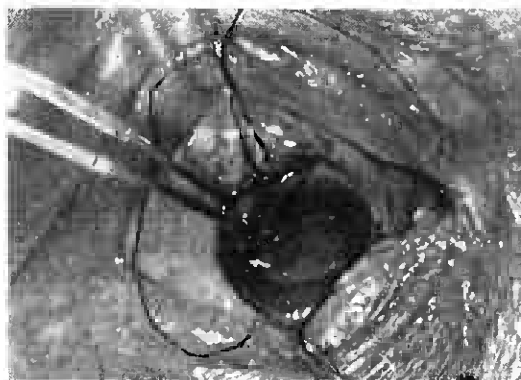


Fig. 11. Extracapsular forceps inserted for anterior capsulotomy.



Fig. 15. Air injected after the preplaced suture was tied.

ral anaesthesia more popular, although we still operate with local anaesthesia for several reasons. The main reason is that we are quite satisfied with our method of anaesthesia, although it is also partly because the local anaesthetists are not convinced that general anaesthesia is superior and partly because of the local shortage of anaesthetists.

The constant improvement of design and production of finer instruments have come to make cataract surgery comparatively easy. The erisophake, which can be used instead of forceps in intracapsular extraction, acts by suction and is often invaluable especially when alpha-chymotrypsin is used. This technique was successfully used in 11 cases.

An interesting addition is the new, small pencil-like instrument called the cryoextractor which when applied to the lens freezes the capsule and cortex, adhering them to its tip. The lens is then removed as with the forceps or erisophake by the sliding method.

SUMMARY

- 1). The article analyses 100 cases of cataract extraction done by the author.
- 2). The commonest indication for cataract extraction was visual defect.
- 3). The importance of properly administered anaesthesia, akinesia and sedation was emphasised.
- 4). The operative technique and its variations were described and discussed.
- 5). The visual result was analysed and normal vision (6/9 or better) was the result in over 90% of cases and vision was improved in

all except one case, if other eye diseases causing defective vision were eliminated.

- 6). The recent advances in cataract surgery were discussed. The author recommends the use of alpha-chymotrypsin for patients between the ages of 20 to 50 years and intraocular acrylic lens implants in selected cases of unilateral aphakia.

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