T I T L E

THE OUTCOME OF CATARACT SURGERY :
EXTRACAPSULAR VERSUS INTRACAPSULAR CATARACT EXTRACTION FOR SENILE CATARACTS.

BY

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DECLARATION

This dissertation is my own original work and has not, to my knowledge, been presented for any degree in any other University.

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This dissertation has been submitted for examination with my approval as a University supervisor.

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SUMMARY

A total of 200 patients who had cataract surgery by primary extracapsular (ECCE) or intracapsular cataract extraction (ICCE) between January 1990 and May 1993, 100 in each series, were studied and compared. The study included retrospective and prospective cases. The ages of the patients ranged from 50-93 years and the male : female ratio was 1.22 : 1.

The total period of follow-up ranged from 10 weeks to 26 months, with a mean follow-up of 15 months in the retrospective group and 3 months in the prospective group.

Pre-operative visual acuities were 6/60 in 4 (2%), 'Counting Fingers' in 67 (33.5%), 'Hand Movements' in 84 (42%) and 'Light Perception' in 45 (22.5%) of the cases.

At 3 months the visual outcome in the ICCE series was significantl better than in the ECCE series, with 93.8% best corrected visual acuities of 6/18 or better in the ICCE series compared to 72.9% in the ECCE series. Considering the visual results at 6-8 weeks and the subsequent visual acuities, the ICCE cases had an earlier, better and more stable visual result compared to the ECCE cases.

Complications varied in nature and frequency, the most frequent in the ECCE series being striate keratopathy (78%), iris atrophy (58%), accidental rupture of the posterior capsule (22%) and opacification of the posterior capsule (13%) ; while the most frequent complications in the ICCE series were striate keratopathy (48%), iris atrophy (45%), vitreous in the anterior chamber (80%) and intra-operative vitreous loss (33%).

The most significant complications with respect to visual outcome were opacification of the posterior capsule and severely up-drawn

pupils in the ECCE and ICCE series respectively.

The ICCE cases had a shorter post-operative period of hospitalization. 57% of the patients in the ICCE series were discharged by the 5th post-operative day as compared to 48% in the ECCE series.

INTRODUCTION

The clarity of the crystalline lens is very important to its function of refraction, whereby it normally focuses images sharply on the retina. Other attributes to this important function are the anatomical shape of the lens and the efficiency of accommodation.

Cataract, which describes an opacification of the lens and therefore a loss of clarity, is a leading cause of blindness in Kenya. Indeed, it is a major cause of visual disability all over the world (1)

Following surgical extraction of a cataractous lens by one of the standard surgical methods in practice, the important role of retraction has to be achieved either through spectacle correction, contact lenses or intra-ocular lenses. Significant improvement in visua acuity is the case in the majority of cases though the degree of improvement seems to vary from patient to patient, and also differs with the various surgical methods. Such variability is also observed in the complication rates with the different methods.

It is with this in mind that I decided to carry out this study, with an aim to :-

1. Comparing the visual outcome of patients who underwent cataract extraction by the primary extracapsular procedure versus the intracapsular procedure, and thereby drawing conclusions on the visual results of our surgical methods.

2. Comparing the types and rates of complications seen in each of these two groups of patients.

3. Comparing the lengths of hospitalization periods between these two groups of patients.

LITERATURE REVIEW

Cataract is the term used to describe opacification of the crystalline lens within the eye, whereby it loses its transparency. Classification of cataracts can be by :-

1. Age : congenital, developmental, pre-senile or senile.
2. Stage of development : incipient, early, mature, intumescent or hypermature.
3. Aetiology : primary e.g.senile cataracts or secondary e.g. traumatic, toxic or following ocular or systemic disease.
4. Morphology : nuclear, cortical, polar or subcapsular.

The term senile cataract includes all forms of cataract which occur in a senile patient in the absence of associated congenital disease, ocular trauma, systemic or ocular disorders or toxicity. In most cases, the cataracts are bilateral although the rate of progression in each eye is seldom equal. Senile cataracts are of three main types :-

1. Subcapsular (cupuliform) cataracts may be anterior or posterior. Patients with posterior opacities have worse vision in bright illumination and their vision for near is frequently diminished more than their distance vision.
2. Nuclear (sclerosis) cataracts usually start as an exaggeration of the normal ageing change involving the lens nucleus. In its early stages it is frequently associated with myopia due to an increase in the refractive index of the lens nucleus.
3. Cortical (cuneiform) cataracts are those in which the opacification involves the anterior, posterior or equatorial cortex.

There is at present no proven effective medical treatment in

the management of cataracts. Temporary measures for aiding the poor vision associated with cataract include mydriatic drops for axial opacities or hand-magnifying glasses. The role of non-steroidal anti-inflammatory drugs in retarding the progression of cataracts is still not clear.

Surgery, by extraction of the cataractous lens is the mainstay of management of senile cataracts. There are two different approaches :-

1. Extracapsular cataract extraction (ECCE) -with or without phacoemulsification, as a primary procedure or with intra-ocular lens implantation.
2. Intracapsular cataract extraction (ICCE) - with or without enzyme zonulolysis, as a primary procedure or with intra-ocular lens implantation.

In both, the globe is opened through the corneo-scleral junction in its upper half and sutured after lens extraction. In ECCE, the lens is extracted leaving behind the posterior capsule with its zonular attachments. It is more suitable for mature cataracts because clear lens fibres are sticky and more difficult to remove. In ICCE, the lens is extracted in toto, leaving the anterior face of the vitreous exposed to the iris and the anterior chamber.

The indication for surgery in senile cataracts is most often for visual improvement; though in some cases this is associated with a medical factor for example an intumescent cataract with secondary glaucoma, or lens-induced uveitis.

Critical pre-operative evaluation of the senile cataract patient is crucial both in anticipating the course of surgery and

predicting the visual outcome.

Of the classified types of cataract, senile cataract is the commonest group and in 1963 was responsible for approximately 50% of all cases of blindness in Kenya (2). According to a report by A. Fuchs, 1962, in every country in the world for which statistics are available, operations for cataract are much more numerous than for any other ophthalmological condition (3).

It is thought that there is a genetic factor in its incidence because of the frequency of family history of cataract among senile cataract patients. Gompertz plots have been applied to the epidemiology of senile cataracts. They may be used separately for men and women, and enable a distinction to be made between inborn and environmental influences. In particular, myopia and the effects of ultraviolet light may be linked to the development of cataract (4).

Concerning the morphological types, J. Foster and J. Benson (1934) found the cuneiform type to form the majority. They reported 22% nuclear, 6% cupuliform, 37% cuneiform, 17% punctate perinuclear and 18% mixed, in which category the nuclear cataract predominated (5). They also found that the cupuliform type occured earliest with a maximum incidence between 50-60 years, the cuneiform and punctate between 60-70 years and the nuclear variety between 70-75 years. Over most of the world it has been said that the average age for operation is 65 years (Gradle, 1930). More than one morphologic type often occur in association in the same eye, and if surgery is indicated, cataract surgery improves visual acuity in over 90% of cases (6).

Types and frequencies of complications in cataract surgery

have been evaluated. Krieglstein et al, in 1980 published a report of 4,300 cataract extractions with a follow-up period of 1-3 years in 726 eyes. Severe intra-operative complications included vitreous loss (5%), accidental rupture of the lens capsule in planned extracapsular extraction (4.3%) and haemorrhage (1.8%). Late complications were secondary glaucoma (1%), corneal dystrophy (1.1%), retinal detachment (1.8%) and endophthalmitis (0.44%) (7). This study was mainly on intracapsular extraction.

The indications for extracapsular surgery in senile cataract patients are present in any case where for some reason intracapsular extraction is thought to be hazardous or unsuitable. Relative indications would include patients between the ages of 40-60 years, patients with high myopia and those in whom ischaemic retinopathy is suspected. R.J.H. Smith et al emphasised that removal of the anterior lens capsule over as extensive an area as possible is the key to success in extracapsular cataract surgery, usually achieving a good and stable visual result, and that manouvres such as polishing the posterior capsule and even the exceptionally careful and complete removal of cortical matter are of less importance (8). Other studies report a lower incidence of opacification of the posterior capsule when care is taken to polish the capsule at the end of surgery.

In a comparison of the results in 17 patients with cataract (aged 50-88 years) in whom extracapsular cataract extraction had been done in one eye and intracapsular cataract extraction in the other, it was concluded that

1.with extracapsular extraction there was no vitreous in the anterior chamber, no pupillary blockage, less tendency to retinal detachment and to macular oedema;

2. with intracapsular extraction there was better vision and less glaucoma and uveitis, but a less 'stable vitreous' with more risk of retinal detachment and macular oedema (9).

In another comparison of intracapsular and extracapsular surgery (a histopathological study of eyes obtained post-mortem), 201 eyes were evaluated. Of these, 146 had undergone intracapsular and 55 extracapsular surgey. Out of the 55 patients who had extracapsular surgery, 30 had the posterior lens capsule intact (ECCE-CI) and 25 had discission, during surgery, of the posterior capsule (ECCE-D). Wound-related complications were more in the intracapsular surgery group :-
Posterior vitreous detachment occured in 84% of eyes following ICCE, in 76% of eyes following ECCE-D, and in 40% of eyes following ECCE-CI. Peripheral retinal holes were found in 8.2% of ICCE eyes, 8.0% of ECCE-D eyes and 3.3% of ECCE-CI eyes (10).

Cystoid macular oedema is probably the most common post-operative complication, in the posterior segment, of cataract extraction (11,12,15). Fortunately, the great majority of cases are transient and have little clinical significance as they occur during the immediate and early post-operative period. Of those that persist, most resolve in six months, leaving good vision (12).

Retinal detachment occurs with a higher frequency in aphakic patients compared to the general population. And even among aphakic eyes, there are additional risk factors. Retinal detachment is reported by some to be rare in the black as compared to other races (13). In a report of retinal detachment in myopic eyes after intracapsular and extracapsular cataract extraction (14), two series of eyes with myopia which underwent uncomplicated cataract surgery, and which required an aphakic correction of +7.00 DS

spherical equivalent or less were evaluated. 7 out of 122 that had intracapsular surgery and 1 out of 151 that had extracapsular surgery developed post-operative retinal detachment. The extracapsular technique is recommended by the authors for cataract surgery in myopes.

Extracapsular and intracapsular cataract surgery have been further compared and emphasis made on the advantages and disadvantages of each over the other. It has been postulated that maintaining the natural barrier between the anterior and posterior segments of the eye may have both anatomical and physiological advantages (15). Anatomical advantages of ECCE include :-

- Vitreous loss is much less common, particularly with cataract extraction in younger patients.
- Vitreous herniation into the anterior chamber is prevented, and the possible undesirable effects of vitreo-endothelial touch lessened.
- The incidence of retinal break formation and subsequent aphakic retinal detachment seems to be less following extracapsular extraction.
- Endophthalmodonesis (refering to the relative mobility of intra-ocular structures) is much less, and the actual clinical benefits of this include a lower incidence of cystoid macular oedema.

A physiological advantage postulated is that the diffusion of potentially toxic or harmful substances from the posterior to anterior chamber or vice-versa may be prevented or retarded by an intact posterior capsule. This is an important consideration in patients likely to have ischaemic retinopathy.

Disadvantages of ECCE are that :-

- The technique is more difficult and is associated with a greater loss of corneal endothelial cells than intracapsular extraction (15). The instrumentation also includes an operating microscope with co-axial illumination.
- The post-operative course is generally more stormy, with particular reference to uveitis.
- Post-operative opacification of the posterior capsule. There are conflicting reports on the opacification of the posterior capsule ; some report an incidence in excess of 50% in the long-term, and recommend a routine posterior capsulotomy at the end of each operation in order to save the patient from a second intervention later. In cases where care is taken to polish the posterior capsule at the end of surgery, the incidence is reportedly lower (10-20%) (15, 16).

The advantages of ICCE, particularly pertinent to a developing country, are that (16) :-

- ICCE is a much faster operation, and in the majority of cases the amount of intra-ocular manipulation is much less. This reduces post-operative inflammation and also theoretically reduces the danger of contamination of the eye with micro-organisms and subsequent infection.
- Irrigation fluids are needed less often and in less quantities.
- It is an easier technique to teach and learn in cases where ophthalmic assistants are required, and especially concerning eye cam
- The basic instrumentation required is relatively much cheaper.
- The visual result is better, comes about much faster and is more permanent after intracapsular compared to extracapsular surgery.
- The post-operative course is generally much less stormy.
- There is less likelihood of exposing the patient to a second

operation, such as capsulotomy, with all the associated likely complications.

- Retinal detachment is a rare complication, but if it does develop, surgery is likely to be much simpler after an intracapsular as compared to extracapsular surgery.

On cataract surgery and the corneal endothelium, it has been reported that a reduction in numbers of the endothelial cells could be caused by intra-operative damage, post-operative inflammation or spreading of the cells to the peripheral cornea to cover areas of cell loss e.g. at the corneo-scleral incision site (17). Studies on the effects of irrigation fluids and air on the corneal endothelium have mainly been experimental. But it has been noted (18) that prolonged contact of an air bubble on the endothelium results in an area of endothelial cell loss. Similar effects have been observed with the use of non-physiological irrigation fluids.

Post-operative astigmatism greater than 2.0 DC has been considered as being a complication of cataract surgery in reports of many studies. A technique described by Awan (19), using internal closure of the scleral wound with a scleral flap was found to reduce the degree of astigmatism. There were 6 out of 53 (11.3%) eyes with astigmatism greater than 2.0 DC in this series, compared to 11 out of 53 (20.8%) eyes with astigmatism greater than 2.0 DC in those where operation was done using the traditional methods of wound closure. This technique is, however, not widely used.

The role of the out-patient departments in the pre-operative observation and evaluation and the post-operative treatment of patients with cataract has been discussed. Shorter hospitalization periods are becoming more and more preferable with the rising costs of in-patient care. Day-case surgery has been tried (20,21), and

In a large series, day-case cataract surgery proved to be safe and acceptable to patients.

AIMS AND OBJECTIVES

This study was carried out to

1. Compare the visual outcome of cataract surgery done by the primary extracapsular versus the intracapsular cataract extraction methods.

2. Compare the complication rates (intra-operative, early post-operative and late post-operative) of cataract surgery done by the two methods.

3. Compare the periods of hospital stay post-operatively and thereby project on the overall cost of surgery by the two methods.

4. Determine practical criteria for specific groups of patients being suitable or unsuitable for either extracapsular or intracapsular surgery and thereafter make necessary recommendations.

MATERIALS AND METHODS

This was a case study including 75 retrospectively studied cases between January 1990 - April 1992 and 125 prospectively studied cases between May 1992 - May 1993.

A total of 100 primary extracapsular and 100 intracapsular cataract extractions were studied. The reference population was the patients with senile cataracts requiring surgery and admitted to the Kenyatta National Hospital eye wards and the Kikuyu Hospital eye unit : consecutive eligible patients who had been surgically managed during the specified periods.

Criretia for Inclusion :-

1. Otherwise healthy patients aged 50 years or over with senile cataracts, admitted for surgical management after adequate pre-operative evaluation.
2. Consecutive eligible eyes operated on by either primary extracapsular (ECCE) or intracapsular (ICCE) cataract extraction.
3. Patients for whom adequate follow-up was possible for a period of at least three months.

riteria for Exclusion :-

. Conditions compromising the state of health of the patient.

a, any active or acute systemic disease e.g. tuberculosis and malaria.

b, any uncontrolled chronic systemic disease e.g. chronic cough, diabetes mellitus, hypertension, malnutrition and chronic cardiac disease.

Local conditions which were considered as risk factors likely to mpromise the outcome of surgery.

a, Local active infection of the eyeball or neighbouring

structures such as the lids or lacrimal sac.

b. trauma to the eyeball such as concussion, irradiation or chemical injury ; which may have occured in the past or was evident at the time of initial pre-operative assessment.

3. State of the eyeball.

a. the pupil was carefully assessed, and only eyes with a normal and active pupil were included, a dilated and inactive pupil being a definite exclusion.

b. projection of vision (light) was required to be accurate and if not, such an eye was excluded.

c. ocular tension was required to be normal, normal being defined as between 10mm Hg and 21mm Hg. Pressures outside this range were considered abnormal in the context of this study.

d. manifest squint in a pre-operative patient.

e. corneal abnormalities such as opacities, oedema or signs of dystrophic or degenerative disorders.

f. iris abnormalities including rubeosis, significant degrees of atrophy, synechiae, pseudo-exfoliation or growths.

g. disorders of the vitreous and retina, notably significant degrees of vitreous opacities and retinal detachment; were diagnosed on clinical evaluation and when found such eyes were excluded from the study. Ultrasonic assessment was only done in some patients and was not routine in the pre-operative assessment.

h. as far as was clinically possible, all other pathology of the lens other than cataract were excluded, thereby eliminating from the study any eyes with, for example, abnormalities in lens position.

The study factors were

a, the comparative visual outcomes in the two groups in terms of the best visual acuity with correction after objective and subjective refraction

b, the comparative complication rates, and

c, the average period of hospitalization, post-operatively for each group.

Outcome factors :-

With adequate consideration of the results obtained from the study factors, it was hoped that choice criteria for either operation would be obtained. There were possible sources of bias in the outcome of the study factors which included

1. Surgeon : consultant eye surgeon versus registrar versus ophthalmic clinical officer in training.

2. Pre-operative and post-operative assessment and management differed from patient to patient and from centre to centre.

3. Patient follow-up was variable, especially after discharge from hospital.

Measurements :-

The important patient parameters obtained were recorded in a separate data-collection form (see appendix) for each patient.

The first part of this form contains patient-identification details, and details of times of admission, operation and discharge. The second part contains any relevant medical history and / or use of medication.

The third part deals with the pre-operative assessment. This included complete general and ophthalmic evaluation. In the general evaluation, assessment was made to rule out any concurrent systemic disorder. In patients already unilaterally aphakic and being

assessed for operation of the second eye, history of complicated cataract extraction was sought. The important ophthalmic parameters evaluated included

1. Visual acuity assessment using Snellen's charts both without and with a pin-hole, and checking the projection of vision with a point source of light. This was then followed up post-operatively, with adequate correction after refraction.

2. Intra-ocular pressures were measured by applanation tonometry. The values recorded pre-operatively were used as reference points for any changes observed post-operatively, and only consistent differences of 4mm Hg or more were recorded as significant.

3. Exact clinical description of the cataract morphology, in mydriasis, was made for the prospective cases and those retrospective ones for which such a record was available.

4. Direct and indirect ophthalmoscopy in full mydriasis.

5. An attempt was made to determine macular function in the cataractous eyes in all the prospectively studied cases, using the Maddox rod, the two-point light discrimination test and colour-perception tests.

The fourth part of the form includes details of the intra-perative management. Indication was made as to whether ECCE or ICCE urgery was done, and for which eye. All the surgical complications ere recorded for each operation where such events occured. re-operative mydriatics were routinely used.

Patients in whom accidental rupture of the anterior capsule curred during planned ICCE, and therefore designated as 'unplanned CCE' in the operation notes were listed here as ICCE with th complication, and not as ECCE. And for the patients planned for CE where accidental rupture of the posterior capsule occured, it

was indicated whether or not this was associated with vitreous loss.

For all the patients included in this study cataract surgery was done under local anaesthesia, and the technique performed was a combination of retro-bulbar injection and the O'Brien facial nerve block, with or without a van Lint block. The retro-bulbar injection was followed by oculopression. The cases which were poorly anaesthetised and had to be given a repeat of retro-bulbar injection, and those who developed complications such as retro-bulbar haemorrhage were automatically excluded from the study as these were considered to be additional risk factors for the surgery.

Description of the Basic Surgical Techniques :-

In primary ICCE

1. A 180 degree fornix-based conjunctival flap was made superiorly from 3 to 9 o'clock.
2. An ab-externa limbal incision was made, followed by pre-placement of a limbal security suture at or adjacent to the 12 o'clock position.
3. The lens was extracted using a cryo-probe. No enzyme zonulolysis was used.
4. A basal peripheral iridectomy was done.
5. The limbal incision was closed using 8/0 virgin silk, rarely 10/0 nylon or sometimes 7/0 vicryl interrupted sutures.
6. The same sutures used for closure of the limbal wound were normally used to adapt the conjunctiva, one each at the 3 and 9 o'clock extremeties. Rarely, the conjunctiva was adapted using the autery forceps or just by placement in its original anatomical position.
7. Local antibiotics either topically or sub-conjunctivally or both,

and topical mydriatic were used and an eye pad applied. Only rarely were local steroids used.

In the cases complicated by accidental rupture of the anterior capsule the lens matter was cleared from the anterior chamber using a syringe with normal saline, balanced salt solution or Hartman's solution with a one-way cannula ; followed by anterior vitrectomy using micro-sponges and scissors (and rarely, a mechanised vitrectomy machine), where indicated.

An operating microscope, or sometimes operating loupes were used for the surgery.

In primary ECCE

1. A 160 degree or less fornix-based conjunctival flap was made superiorly.
2. A limbal groove was made, followed by anterior capsulotomy using bent G.25 needle as a cystotome with or without irrigation.
3. An ab-externa limbal wound was completed to its extent, and the ucleus delivered using a vectice loop with or without irrigation, ith counter-pressure where this was indicated.
4. Cortical washout was done with an irrigation-aspiration cannula sing normal saline, balanced salt solution or Hartman's solution, ith 0.5-1.0 mls of adrenaline per 500 mls of solution.
5. Closure of the limbal incision was performed with 8/0 virgin silk - 10/0 nylon, and adaptation of the conjunctiva done as for ICCE.
6. Local antibiotics and steroids, either topical or sub-conjunctival both were used with topical mydriatics, and an eye pad applied.

In the cases of accidental rupture of the posterior capsule sociated with vitreous loss, the rest of the posterior capsule was ten removed and this followed by anterior vitrectomy as described

for ICCE.

No phaco-emulsification was used. An operating microscope was used for the surgery.

The final part of the form contains the details of the post-operative assessment and follow-up. Patients were reviewed at discharge, at 6-8 weeks, and at 3 months. Assessment for all patients included slit-lamp examination with particular attention to the cornea, anterior chamber, the state of the anterior vitreous face and the development of any complications. Measurement of intra-ocular pressure and ophthalmoscopy was repeated at each visit. Stereoscopic biomicroscopy using the Goldmann 3-mirror fundus contact lens was performed when indicated e.g. in diagnosis of cystoid macular oedema. Fluorescein angiography was not done in any of the patients.

Refraction - both objective and subjective - was done at the 6-8 week and the 3 months' visits, and the visual outcome of the surgery evaluated.

The cumulative complications occuring during the post-operative period were classified for each patient under three specifications depending on when they were noted :-

1. Immediate post-operative period 0 - 3 days.
2. Early post-operative period 4 days - 2 weeks.
3. Late post-operative period 2 weeks or more.

Opacification of the posterior capsule was recorded as a complication only when visually significant and the very early or peripheral opacities were excluded.

Evaluation of the visual outcome was carried out for each operated eye using

1. Only the spherical component of the retinoscopic refraction.
2. The full retinoscopic refraction.
3. The spherical equivalent of the retinoscopic refraction.

The best visual acuity was determined and recorded. The corrected near vision was also determined.

For ease of data analysis, visual acuity was grouped as complete lines e.g. 6/9(p) was regarded as 6/9 and so on. The progressive changes, if any, of the visual acuity were compared with the best corrected vision obtained at the 6-8 weeks' assessment. For the eyes with corrected visual acuity poorer than 6/18, an effort was made to determine the cause of poor vision. The same was done for the eyes whose vision was poorer at subsequent assessments as compared to the 6-8 weeks' record.

For the retrospective, and in some instances also prospective cases not followed up at the specified time periods post-operatively, records were made of the findings at the next nearest time that the eyes were reviewed.

The post-operative assessment at 6 months or more was optional. At this time only new findings or complications were recorded. If visual acuity was poorer than that recorded at 3 months, an explaination for this was sought.

RESULTS

TABLE 1

This shows the general statistics obtained upon review of the cases followed up in this study.

1a. There were 100 eyes in the extracapsular cataract extraction (ECCE) and 100 in the intracapsular cataract extraction (ICCE) series. In each series. there were both retrospective and prospective cases.

1b. The range of ages was 50-93 years, with an overall peak in the 60-69 year age-group. When considered separately. most (47%) of the ECCE cases were in the 60-69 year age-group while most (41%) of the ICCE cases were in the 70-79 year age-group. The average age for cataract operation in this study was 68.3 years. There were only 25 patients aged 80 years and above.

1c. The male : female ratio was 1.6 : 1 in the ECCE series as compared to 0.9 : 1 in the ICCE series.

1d. Shows the pre-operative visual acuities. The majority had a visual acuity of 'Hand Movements' (42%) while only 4 (2%) had a visual acuity of 6/60. None had visual acuities better than 6/60.

On pre-operative evaluation of macular function in the prospective cases, only in 68 out of the 125 was it possible to get a sensible and consistent response from the patient using the Maddox rod. The two-point light discrimination and colour perception tests yielded slightly better responses.

Surgery improved the visual acuity in 98% of eyes by the 3 months' assessment. Of the 4 eyes with poor visual acuity, 1 patient was on management for aphakic retinal detachment. one was undergoing

treatment for endophthalmitis, and the other two had developed mark opacification of the posterior capsule which had progressively lowered the visual acuities to the pre-operative levels.

Among the prospective cases, the most common morphological ty of cataract encountered was the mature type (36%), followed by the cortical (17.6%) then the mixed type (16%). The nuclear and cupuliform types occured with low frequencies (14.4 and 12.8% respectively). The cupuliform cataract occured at an average age o 54.2 years, the nuclear at 65 years, the mature at 70 and the cuneiform cataract at an average age of 68 years.

TABLE 2

This table indicates the comparative numbers of sutures used wound closure in the two series. It also shows the degree of post-operative astigmatism.

2a. Out of the 88 ECCE cases recorded, most (85%) had 5 or less sutures used, while of the 87 ICCE cases recorded, the majori (59.8%) had 6-7 sutures used in wound closure.

2b. Of the 88 ECCE cases, 70.5% had less than 2.0DC, 21.6% had 2- and 7.95 had more than 4.0DC of astigmatism. Of the 87 ICCE c 60.9% had less than 2.0DC, 28.7% had 2-4DC and 10.3% had more than 4.0DC of astigmatism.

TABLE 3

This table compares the visual acuity with best subjective correction at the 6-8 weeks' assessment (3a) with that at 3 month (3b) in the two series. A total of 4 patients from the ECCE and 3 patients from the ICCE series were lost to follow-up between thes two visits.

The results here indicate that 79 eyes had a visual acuity of 6/9 or better by 6-8 weeks post-operatively. Most (60.8%) of these were in the ICCE series as compared to those (39.2%) in the ECCE series. Out of 11 patients with visual acuity of 6/60 or worse by 6-8 weeks post-operatively, most (72.7%) were in the ECCE series as compared to those in the ICCE series (27.3%).

6 patients from the ECCE series had worse corrected visual acuity at 3 months compared to the vision at the 6-8 weeks' assessment. Only one patient from the ICCE series had a deterioration of visual acuity between these two clinic visits.

The worst recorded post-operative visual result was 'Perception of Light' in an eye which had undergone ECCE and developed endophthalmitis in the early post-operative period.

TABLE 4

The visual acuities were recorded at the 3 months' assessment for the two series. This table shows the visual results obtained by correcting the aphakic eyes with

i. Only the spherical component of the retinoscopic refraction

i. The full retinoscopic refraction

ii. The spherical equivalent of the retinoscopic refraction.

An attempt is made to correlate the visual acuity achieved after correction with the degree of post-operative astigmatism. From the results obtained, a general trend was observed :-

. For cases with lesser degrees of astigmatism (less than 2.0DC), he best visual result was normally achieved by using the full etinoscopic correction. But using only the spherical component of he retinoscopic refraction or a spherical equivalent of the etinoscopic refraction also achieved satisfactory results - the

visual acuity generally remained the same or degraded by only one line on the Snellen's chart. except for one case in the ICCE series where visual acuity degraded by two lines when only the spherical component of the retinoscopic refraction was used.

2. For cases with moderate degrees of astigmatism (2-4DC), the best visual result was achieved by using the full retinoscopic correction. The spherical equivalent gave the next best results, though there was a significant degradation of visual acuity of at least two lines. Correction using only the spherical component of the retinoscopic refraction gave poor results.

3. For cases with higher degrees of astigmatism (more than 4.0DC), similar visual results were achieved using the full retinoscopic correction or the spherical equivalent. But a significant number of patients (81%) with full retinoscopic correction were intolerant of the spectacle correction. Better spectacle tolerance was achieved by using the spherical equivalent. In this group, the visual results achieved by using only the spherical component of the retinoscopic refraction were generally very poor.

. Visual acuity with full retinoscopic correction in the lesser id moderate degrees of astigmatism, and with the spherical uivalent of the retinoscopic refraction in the higher degrees of tigmatism were closest to the best subjective aphakic correction.

In 88% of cases, corrected near visual acuity was found to rrespond to the best corrected distance acuity. In the remaining %, visual acuity less than 6/60 or communication barriers made it fficult to make an accurate assessment of the near visual acuity.

BLE 5

Complications arising both during and after surgery were

recorded. The most common complications in the ECCE series (5a) were striate keratopathy (78%), iris atrophy (58%), intra-operative accidental rupture of the posterior capsule with vitreous loss (17%), opacification of the posterior capsule (13%) and severe post-operative uveitis (11%).

The most common complications in the ICCE series (5b) were vitreous in the anterior chamber (69%), striate keratopathy (48%), iris atrophy (45%), abnormal updrawn pupil (21%) and vitreous loss intra-operatively (33%).

Accidental rupture of the posterior capsule occured in 22% of the ECCE cases, and this was associated with vitreous loss in 17% of the series. Comparatively, 21% of the ICCE cases had accidental rupture of the anterior capsule, which was associated with vitreous loss in 13% of the series.

One case in the ECCE series had a dilated and fixed pupil post-peratively, whose aetiology was not determined. His best corrected visual acuity was 6/36.

In the long-term, the visually significant complications in the wo series were noted to be opacification of the posterior capsule, rneal 'dystrophy', pupillary membranes and endophthalmitis in the CE series and severely updrawn pupils, corneal 'dystrophy' and tinal detachment in the ICCE series.

Most of the cases of severe post-operative uveitis, striate ratopathy and cystoid macular oedema resolved without serious plications on the final visual results. Opacification of the sterior capsule was found to develop with an incidence in direct portion to the length of time following surgery.

One patient in the ECCE series developed transient exotropia.

The squint was noted 3 months post-operatively. by which time he was still not using aphakic correction. He started wearing spectacles 4 months post-operatively. and the squint soon resolved. But diplopia remained a problem for him until he was last seen, about 8 months after surgery. The pre-operative visual acuity had been 'Hand Movements' in both eyes. He was bilaterally aphakic, the first eye having been operated by ECCE 2 months prior to operation of the second eye. Neither eye had its refraction corrected until 4 months after the second operation.

Out of 69 cases in the ICCE series in whom the state of the anterior vitreous face post-operatively was recorded, 11 had the anterior vitreous attached to the wound site, 39 had it in the anterio chamber but with no vitreo-endothelial touch, one had it in the anterior chamber with vitreo-endothelial touch, 15 had it in the pupil and only 3 had the anterior vitreous face posterior to the pupil.

Clinically detectable persistent cystoid macular oedema caused permanent diminished visual acuity in one patient in the ICCE series. In the rest of the ECCE and ICCE cases who had cystoid macular oedema :he condition resolved spontaneously, leaving a satisfactory visual ·esult. Diagnosis of cystoid macular oedema was by ophthalmoscopy and undus contact lens examination, and was not confirmed by fluorescein ngiography in any of these cases.

Permanent corneal decompensation was noted in 4 of the ECCE as ompared to 1 of the ICCE cases. making the overall rate of corneal ecompensation in this study 2.5%. with a higher incidence following CCE.

Increased intra-ocular pressure post-operatively was observed ore frequently in the ICCE (13%) compared to the ECCE (8%) series. ost of those following ICCE were diagnosed as pupillary block

glaucoma and in the majority, either an incomplete peripheral iridectomy (i.e. only the anterior lamella of the iris was cut) or total absence of a peripheral iridectomy was noted and the cases managed accordingly. In 2 of the ICCE cases, no obvious explaination for the rise in intra-ocular pressure was found. In most ECCE cases, intra-ocular pressure had normalised by 3 months post-operatively.

TABLE 6

Post-operative hospitalization was measured from the first post-operative day (as Day 1) up to the day of discharge, and recorded as number of days. This table shows the comparative periods of post-operative hospitalization in the two series.

The overall picture indicates that the ICCE cases generally had a much shorter period of hospitalization post-operatively compared to the ECCE cases. This was the case in both centres.

When the individual centres were regarded separately, it became apparent that Centre I (Kikuyu Hospital) generally had a shorter period of post-operative hospitalization as compared to Centre II (Kenyatta Hospital).

DISCUSSION

Cataract is a leading cause of blindness in Kenya, and there is a backlog of patients with senile cataract requiring surgical management. The majority of these patients live in rural areas, and unless special considerations are made, most would be doomed to a life of blindness and social incapacity.

Apart from the existing eye-camps and mobile eye units, hospitals also play an important role in the management of cataracts.

This study strove to determine the suitability of different patients with senile cataracts for either extracapsular (ECCE) or intracapsular (ICCE) surgery in terms of best visual outcome, with the minimum of complications and hospitalization expenses. An effort was also made to determine basic pre-operative criteria of evaluation necessary before deciding on the approach of surgery.

Out of 100 patients in each series, 96 of the ECCE and 97 of the ICCE fulfilled the minimum period of follow-up required in this study. Due to long travelling distances involved when followed up in their stations of operation, and financial constraints, more and more patients in time prefered follow-up at centres closer to their homes and were therefore lost to our follow-up.

The majority of cases (64.5%) had pre-operative visual acuities of 'Hand Movements' or worse, and in all the cases in this study the indication for cataract surgery was visual improvement. When the visual outcome at 3 months was compared to the pre-operative visual acuity, 97% of the ECCE and 99% of the ICCE series had better vision.

In a one-year longitudinal follow-up study done by Reidy et al (22), 92% of the patients were found to have adequate vision of 6/18

or better one year after surgery. In this study, 93.8% of the ICCE series compared to 72.9% of the ECCE had a corrected visual acuity of 6/18 or better 3 months after surgery. The results from the ICCE series compare favourably with those of Reidy et al. However, due to the unstable nature of the visual result following ECCE, some visual acuities in this series seemed to get poorer with time.

Comparison of the best corrected visual acuities for the two series at the 6-8 weeks' and the 3 months' assessments indicate that the ICCE series had a relatively better visual outcome much earlier in the post-operative period, and that this remained more stable with time compared to the ECCE series. This compares well with the findings of Quintana et al (9). It also agrees with the conclusions of Alpar (15).

This poorer visual acuity early in the post-operative course, of the ECCE series, seemed to be multifactorial. There was a higher incidence of severe uveitis compared to the ICCE series. Factors such as the frequently seen striate keratopathy and subclinical cystoid macular oedema may have contributed. In some cases significant opacification of the posterior capsule occured quite early post-operatively and adversely affected vision.

Of the 8 patients in the ECCE series with visual acuities worse than or equal to 6/60 at the 6-8 weeks' assessment, 1 had a persisten maculopathy, 2 had pupillary membranes, 2 had severely updrawn pupils 1 had endophthalmitis and 2 had dense opacification of the posterior capsule. Of the 3 patients in the ICCE series with visual acuities of 6/60 or worse, at the same time, 1 had had aphakic retinal detachment and 2 had severely updrawn pupils.

Apart from the complications arising, the refractive result of

surgery also seemed to determine the visual outcome. This is particularly in reference to the degree of astigmatism.

Astigmatism of more than 2.0DC has been regarded by some as being a complication of cataract surgery. If this was applied to this study, less cases (29.5%) of the ECCE as compared to the ICCE series (39.1%) would be recorded as having this 'complication'. Patients with lesser degrees of astigmatism are generally expected to achieve superior visual results with better spectacle tolerance as compared to those with higher degrees of astigmatism.

In this study, although it was possible to achieve satisfactory visual results in cases with higher degrees of astigmatism, intolerance of the spectacle prescription was a problem when the full retinoscopic correction was used so that in most of the patients a spherical equivalent was used instead. In some cases, reduction of the cylindrical component of the retinoscopic refraction was sufficient to improve spectacle tolerance. None of the patients with astigmatism greater than 4.0DC achieved corrected visual acuity better than 6/18.

Though spectacle correction may be the least desirable form of aphakic correction due to their relatively poor optical performance, contact lenses were not found to be a practical alternative in this study. In Kikuyu Hospital, an alternative management option for cases with unsatisfactory visual results due to high degrees of astigmatism was to cut and remove sutures in the critical meridian early in the post-operative period ; this was found to dramatically improve the corrected visual acuity, which then usually had a lower residual cylindrical component.

On cursory evaluation higher degrees of astigmatism seemed to be associated with higher numbers of sutures used in wound closure and

vice-versa; when closely examined, this relationship was found not to be statistically significant. It can therefore be concluded that post-operative astigmatism depends on the surgeon's technique of limbal incision and wound closure rather than on the number of sutures used.

For the patients who had 'successful' therapy, one third were noted to have remained functionally blind by 3 months after surgery because they were not using their spectacle correction. Most of such cases had been managed at Kenyatta Hospital. Apart from those whose spectacles were lost or broken, the Kikuyu Hospital patients did not have this problem. This is because the cost of cataract surgery in the latter centre includes the spectacles, so the patients already had their spectacle correction by the time of discharge, and these were later changed whenever found necessary. In some centres up to 56% of patients (23) have been reported not to have aphakic glasses for quite prolonged periods post-operatively.

Differences in complication rates between ECCE and ICCE have been considered (7,8,9,10,24). In this study, complications encountered were quite varied.

Overall, striate keratopathy and iris atrophy were the most frequent complications. They occured more frequently in the ECCE (78% and 58% respectively) compared to the ICCE series (48% and 45% respectively) and both seemed to be proportionate to the amount of intra-ocular instumentation during surgery. Most cases of striate keratopathy resolved, and iris atrophy did not seem to be a visually significant complication.

Age seems to have had an influence on the occurence of some complications. Notable among these was accidental rupture of the

anterior capsule and vitreous loss in ICCE, which occured most commonly in the 50-59 year age-group. In such cases the zonular attachments to the lens are still quite firm, and a primary ECCE should be planned to avoid this complication. Otherwise, dissolution of the lens zonules prior to ICCE by enzyme zonulolysis e.g. alpha-chymotrypsin may be necessary in these relatively young patients, i.e. below 60 years (12).

Morphology of the cataract should also be a factor to consider in anticipating the course of surgery. It was notable that the 2 patients who had zonular dehiscence intra-operatively in the ECCE series both had mature cataracts.

More cases of wound dehiscence or leakage associated with shallow anterior chambers post-operatively were seen after ICCE as compared to ECCE. This was thought to be partly related to the type of suture material used, as in 63.8% of these cases absorbable, 8/0 vicryl, sutures had been used. The surgeon's technique of wound closure is also a possible factor in cases of wound dehiscence.

Giant papillary conjunctivitis occured rarely, with similar frequencies in both series. Most occured between 4 and 6 weeks post-operatively.and those associated with protruding suture material improved when the offending sutures were removed.

Long-term corneal complications were not frequent. A significant incidence of punctate epithelial erosions and keratitis was found and attributed to the topical therapy. More were in the ECCE series, probably because of the relatively more intense use of topical therapy, particularly steroid combinations in these cases. Various studies report the incidence of corneal oedema following primary ICCE to be in the order of 2-6% (17,18,25). The risk of persistent corneal

oedema (and other problems necessitating corneal transplantation) has been reported to be nearly three times higher after intra-operative vitreous loss and anterior vitrectomy than after uncomplicated cataract extraction (26).

Corneal decompensation post-operatively was noted in more (4%) ECCE compared to ICCE (1%) cases. The overall incidence was 2.5%. But relative to the frequency of striate keratopathy (78% in ECCE and 48% in ICCE), few cases of significant endothelial cell loss that caused corneal decompensation were noted in this study. So although endothelial cell loss occurs around the wound area, and seems to be related to the amount of intra-operative instrumentation and manipulation, there is usually adequate spreading of the endothelial cells during the healing process so that the endothelial function is usually restored to near-normal. The findings in this study compare well with those in literature (7,27), though many of the more recent studies are in relation to intra-ocular lens implantation.

The higher incidence of keratopathy in the ECCE series could also be explained by the greater use of irrigating fluids during ECCE. The relationship between corneal endothelial damage and irrigating fluids and / or air in the anterior chamber has not been consistent in literature, and many of the reported studies have been experimental. In one such experimental study Beesley et al (18) noted that an air bubble on the endothelium for [illegible] during a phacoemulsification procedure resulted in an area of endothelial cell loss. Considering this, it would be recommended that as much air as possible should be removed at the end of a procedure.

The incidence of endophthalmitis was 0.5%, which compares well with the results of Krieglstein et al. In a report by Heaven et al (28), time interval between cataract surgery and the diagnosis of

ophthalmitis (presentation delay) ranged from 1-24 days with a of 4 days. The case in this study followed ECCE and was nosed clinically on the 6th post-operative day. It was the most ally devastating complication in the study, resulting in 'Light eption'.

Late entry of vitreous into the anterior chamber was frequently erved in the ICCE series. An increase in incidence was noted from time of discharge, reaching 66% by the 3 months' assessment, and s was irrespective of whether or not there was vitreous loss at ration. It was not clear from this study at what stage the anterior reous face stabilises post-operatively.

Visually significant opacification of the posterior capsule lowing ECCE occured in 6% of cases by the 6-8 weeks' assessment. By months 7 more cases were noted, making the incidence 13%. There were other cases of peripheral or early opacification which could be pected to increase with time and cause occlusion of vision. Nishi 9) reported a 15% opacification rate, with a minimum follow-up of e year, in eyes that underwent primary ECCE. In another study (30), acification was reported in about 1 in every 5 patients after a riod of 2 years following primary ECCE, and this incidence was und to rise in proportion to the length of time after surgery. Rates high as 50% have been reported (31) with 3-5 years of follow-up.

It has been suggested that the long-term visual implications of osterior capsule opacification can be improved by performing routine osterior capsulotomy at the completion of ECCE. But this would viously decrease the advantages of ECCE over ICCE and also increase he complication rates of ECCE. In cases where this has been done, requently occuring complications included vitreous loss, retinal etachment, cystoid macular oedema, glaucoma and iritis. In a study

Egbert and Buchanan (30), primary capsulotomy was performed in o-thirds of eyes, and complications included a 10% rate of treous loss.

It has been recognised that follow-up is essential after ECCE to sure that poor vision due to posterior capsule opacification is oided by timely management. In our set-up, it is difficult enough to nvince most cataract patients to travel long distances for surgery. d the added burden of follow-up visits is even more daunting. In is study 3.5% (7 out of 125) of the patients studied prospectively re already lost to follow-up by 3 months. Perhaps they were being en at a nearer health institution, or they had altogether stopped eir follow-up visits.

Post-operative increase in intra-ocular pressure was a rare and sually transient complication, more frequently observed after ICCE 3%) as compared to ECCE (8%). Most were mild and did not have a gnificant implication on vision. All except one had resolved by 3 nths. A frequent finding in the ICCE cases with increased intra-ular pressure (9 out of 13) was peripheral anterior synechiae to eas of the wound. Intra-operative vitreous loss was also a common ssociation.

Cystoid macular oedema (CMO) was a transient complication which s normally self-limiting. Most were diagnosed in the early post-erative period, and a marked improvement of visual acuity was ted after resolution. Only one case of persistent CMO was diagnosed, using a permanent impairment of central vision until the time he s last seen 6 months post-operatively. More cases occured after CE (18%) than ECCE (8%), and it was noted in this study that CMO curred at an earlier stage post-operatively in the ECCE as compared the ICCE series.

Irvine originally reported the incidence of this disorder following cataract surgery to be about 2% (32). In some patients a transient CMO occurs, and has been estimated to follow at least 40% of complicated cataract extractions (11). Moses (33) and others (9) included that the incidence of CMO was higher after ICCE than ECCE. Percival (34) recorded rates of 23% after ICCE and 15% after ECCE, but his report included cases of intra-ocular lens implantation. ICCE alone has been reported to have an incidence of CMO of 8.5% in a different study, and the risk is higher in myopes after ICCE by up to 5 times (35).

The relatively lower incidences found in this study may be related to the fact that specific examination for CMO was only made in cases for which no anterior segment findings could explain a poor visual result. Though most cases occured early in the post-operative period and had resolved by 3 months leaving good vision, cases have been known to occur even long after 6 weeks post-operatively (36) and would therefore have been missed in this study.

Retinal detachment is one of the serious, vision-threatening complications of cataract surgery. It occurs in about 2% of aphakic eyes (37). It is a doccumented finding that the majority of patients with aphakic retinal detachment are male. Myopia is an additional risk factor, and in myopia, some studies have reported a higher incidence in female patients (13,38,39). From Bedrick's study (38), patients with high myopia were found to have an incidence of 8.1% of retinal detachment following primary cataract surgery.

In literature, the incidence of aphakic retinal detachment is reported to be higher following ICCE - up to 7% (35) than ECCE. In a study of retinal detachment following cataract surgery (40), Coonan et al noted a 1.4% incidence overall, and a 0.8% rate for patients

intact posterior capsules. If a primary or secondary capsulotomy performed the incidence of detachment rose to 2.75%.

Chambless (25) noted a 0% incidence in 2,863 eyes with intact erior capsules and a 2% incidence in 184 eyes which had had the erior capsule opened. He concluded that the presence of an intact erior capsule definitely protects against posterior segment lications. His study included both YAG-laser and needle-knife ulotomies. In this study only one case of retinal detachment was id. giving an overall incidence of 0.5%. This case followed ICCE, was a male patient aged 63 years. A clinical diagnosis of retinal achment was made 5 weeks after surgery, though the symptoms dated to 4 weeks post-operatively. He was emmetropic.

Some studies report a form of anterior ischaemic optic neuropathy ON) that occurs after cataract surgery. Havreh (41) has described a drome of AION that he feels is different from the general type of N. and frequently associated with elevated intra-ocular pressure in immediate post-operative period and an oedematous optic nerve head. case of post-operative neuritis was diagnosed in this study.

Complications affecting the final visual outcome included ification of the posterior capsule, keratopathy, pupillary brane formation, drawn-up pupils and endophthalmitis in the ECCE ries and drawn-up pupils, keratopathy,cystoid macular oedema and tinal detachment in the ICCE series.

The ICCE cases in this study were noted to have a shorter period post-operative hospitalization compared to the ECCE cases. This was rgely due to the fact that the ICCE cases generally had fewer and ss acute complications, in the immediate post-operative period, equiring intense or prolonged therapy.

Post-operative hospitalization was considered in this study
er than the total period of hospitalization because several
ors. other than the pre-operative work-up of patients, determined
soon after admission the operations could be done. This is mainly
eference to the Kenyatta National Hospital Eye Department, which
izes the general operating theatres for surgical management of
ents. Kikuyu Hospital Eye Department has its own ophthalmic
rre. quite independent from the general operating theatres,. and
i not therefore suffer as much from such constraints as limited
tre time. But even on consideration of the post-operative period
e, Kikuyu Hospital was noted to have a shorter period.

Strong et al (21) and others (20) have reported encouraging
lts with day-case cataract surgery. Strong's study was carried out
large ophthalmic day-case surgical unit over six months. They
ssed on the importance of careful patient selection ; and there
no significant difference in complication rates between day-case
in-patient operations.

Though mortality can usually be ignored, the general morbidity
th may be associated with cataract operations in the aged cannot be
red. But with the rising costs of in-patient care, and from the
uraging results reported, day-case cataract surgery should be
n more consideration. An additional factor not to be overlooked in
environment is whether patients would be able to comply with all
post-operative instructions and medication after discharge.

Considering all these factors, however, it would seem that post-
ative hospitalization for more than four days is not often
cated ; and more than seven days only very rarely indicated.

CONCLUSIONS AND RECOMMENDATIONS

Cataract blindness is one of the most challenging issues facing ophthalmologists. Unlike other leading causes of blindness, it has a straight-forward and effective management that can restore functional vision under ideal conditions. Though intracapsular cataract extraction (ICCE) has proved to be a reasonably successful and cost-effective operation, whether extracapsular cataract extraction (ECCE) or ICCE is the reasonable option would depend on the prevailing local situation.

With time, there is an increasing number of patients coming for cataract operation with better vision ; and consideration of the visual result of surgery is becoming a more critical factor than has been the case in the past. While it is usual to achieve a better visual acuity with pre-operative visual acuities of 'Counting Fingers' or worse, this becomes a more significant goal when the pre-operative visual acuity is still better than 6/60.

Poor optical performance, dangerous restrictions of the peripheral and the quality of central vision make spectacle correction the least desirable for correcting aphakia, but the cost factor - availability of the lenses and the instrumentation, and the surgical techniques - may still be a limitation to the widespread use of ECCE with intra-ocular lens implantation for most of the developing world. Refractive surgery such as keratophakia or keratomielusis in aphakics is still beyond reach for most of our patients because of the expensive and sophisticated instrumentation required, and also the special training required for the procedure.

There are patients for whom consideration of serious complications such as retinal detachment,as in myopic patients with cataract,

outweighs consideration of a likely better visual outcome. As a general observation, note of history of complicated cataract extraction in cases planned for operation of the second eye was found to be important -particularly in ICCE. This is because such complications as anterior capsule rupture, prolonged cystoid macular oedema and intra-operative vitreous loss were found to occur with significant frequencies in the second eye also. In such cases, planned ECCE for the second eye should always be considered.

Though the physiological advantages of having an intact posterior capsule after cataract surgery may be obvious, the occurence of posterior capsule opacification presents multiple logistic problems, particularly in a developing country like Kenya. Most patients must return from long distances to hospitals or eye-camps to receive further management ; and for those unable to return, the potential for compounding the cataract blindness backlog with a backlog of cases of blindness due to posterior capsule opacification needs consideration and discussion. It also means that ophthalmic surgeons must spend more time in the management of each of these patients. This, in addition to the longer time involved in the initial surgery in ECCE, in the long-term makes ECCE a much more time-consuming procedure - a significant consideration, given the few ophthalmic surgeons per capita. Bearing this in mind, ICCE remains a better option for the backlog of cataract blindness, particularly in high-volume eye-camps.

Obviously, this study cannot strive for completeness. While ICCE seems to provide superior visual results early post-operatively, which remain stable in the long-term, there are many instances where good visual results seem to belong to the surgeon's record rather than that of the patient. A significant number of eyes remain functionally blind after 'successful therapy' because spectacles are not bought as

prescribed, or because those obtained after surgery are broken or lost and not replaced. In some studies the incidence of this occurence has been up to 56%.

The period of hospitalization was much shorter in the ICCE series. The question to be answered is not only whether ECCE or ICCE surgery provides the answer to our cataract problem, but also whether ECCE with intra-ocular lens implantation should be considered as a solution on a larger scale whenever possible. Well-designed studies with adequate follow-up are necessary to explore the impact on functional vision of each of these approaches in different settings.

The following recommendations can therefore be made :-

1. In instances where long-term follow-up or intra-ocular lens implantation are not feasible possibilities, ICCE surgery is a better option for senile cataracts and should always be considered first.
2. ECCE, with due consideration of the advantages of an intact posterior capsule, should be considered in cases where ICCE surgery is likely to be hazardous or marred with complications, and in cases where long-term follow-up is possible.
3. In patients already unilaterally aphakic, consideration of the outcome of surgery in the first eye should always be made before deciding on the management of the second eye.
4. The out-patient departments should be better utilised in the pre-operative work-up of patients before admission for surgery, as this would shorten hospitalization.
5. Day-case surgery should be given due consideration, particularly with the rising costs of in-patient care.
6. Use of an independent ophthalmic theatre, such as was previously the case in the eye clinic, Kenyatta National Hospital, should be considered seriously.

7. A study on the fluorescein angiography picture of the fundus following cataract surgery should be considered in the future. This would provide a real picture of the incidence of complications such as cystoid macular oedema.

8. A longer follow-up study may also be more useful in evaluating the long-term evolution of vision following cataract surgery.

9. Where acquisition of spectacles cannot be assured, the cost of the spectacles should be included in the treatment cost so that they can be provided for use before discharge, and later changed if necessary.

TABLE 1a AGE DISTRIBUTION OF PATIENTS

	50 - 59	60 - 69	70 - 79	80 - 89	> 90
ECCE	23	47	19	11	0
ICCE	10	35	41	10	4

TABLE 1b SEX DISTRIBUTION OF PATIENTS

	FEMALE	MALE
ECCE	38	62
ICCE	52	48

TABLE 1c

	PROSPECTIVE	RETROSPECTIVE
ECCE	67	33
ICCE	58	42

TABLE 1d PRE-OPERATIVE VISUAL ACUITIES

6/60+ --- 4 patients

CF --- 67 patients

HM --- 84 patients

PL --- 45 patients

TABLE 2

2a NUMBER OF SUTURES USED IN WOUND CLOSURE

	5 or less	6 - 7	7 or more
ECCE	75	13	0
ICCE	30	52	5

2b DEGREE OF POST-OPERATIVE ASTIGMATISM AT 3 MONTHS

	Less than 2.0DC	2.0 - 4.0DC	More than 4.0DC
ECCE	62	19	7
ICCE	54	25	9

TABLE 3

VISUAL ACUITY WITH BEST SUBJECTIVE CORRECTION AT 6-8 WEEKS

	GOOD	SATISFACTORY	FAIR	POOR
ECCE	31	49	12	8
ICCE	48	40	9	3

VISUAL ACUITY WITH BEST SUBJECTIVE CORRECTION AT 3 MONTHS

	GOOD	SATISFACTORY	FAIR	POOR
ECCE	30	40	17	9
ICCE	53	38	4	2

NB: 4 patients in the ECCE group and 3 patients in the ICCE group were lost to follow-up after the 6-8 weeks' assessment and were not seen at 3 months or later.

KEY TO TABLE:- GOOD = 6/9 or better

SATISFACTORY = 6/18 - 6/12

FAIR = 6/36 - 6/24

POOR = 6/60 or worse.

GRAPH 1

BEST CORRECTED VISUAL ACUITY AT 6-8 WEEKS VERSUS 3 MONTHS

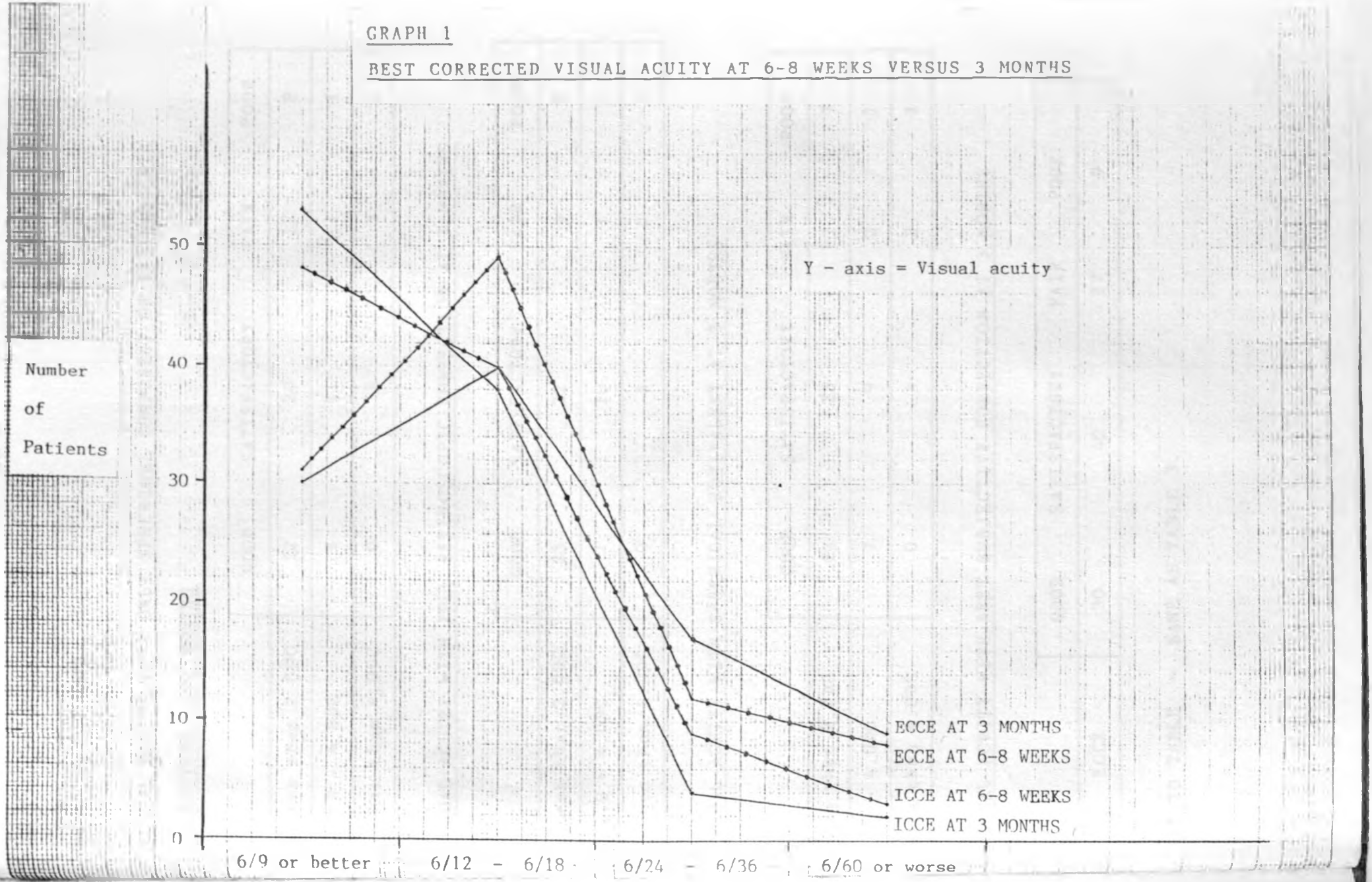

TABLE 4a - ECCE

VISUAL ACUITY WITH ONLY SPHERICAL COMPONENT OF RETINOSCOPIC REFRACTION AT 3 MONTHS

	GOOD	SATISFACTORY	FAIR	POOR
Less than 2.0DC	22	20	12	8
2.0 - 4.0DC	6	11	1	1
More than 4.0DC	0	3	3	1

VISUAL ACUITY WITH FULL RETINOSCOPIC CORRECTION AT 3 MONTHS

	GOOD	SATISFACTORY	FAIR	POOR
Less than 2.0DC	23	22	9	8
2.0 - 4.0DC	7	10	1	1
More than 4.0DC	0	4	2	1

VISUAL ACUITY WITH SPHERICAL EQUIVALENT AT 3 MONTHS

	GOOD	SATISFACTORY	FAIR	POOR
Less than 2.0DC	23	25	7	7
2.0 - 4.0DC	7	9	2	1
More than 4.0DC	0	4	2	1

VISUAL ACUITY WITH BEST SUBJECTIVE CORRECTION AT 3 MONTHS

	GOOD	SATISFACTORY	FAIR	POOR
ECCE	30	40	17	9

KEY TO TABLE = SAME AS TABLE 3.

TABLE 4b - ICCE

VISUAL ACUITY WITH ONLY SPHERICAL COMPONENT OF RETINOSCOPIC REFRACTION AT 3 MONTHS

	GOOD	SATISFACTORY	FAIR	POOR
Less than 2.0DC	33	17	3	1
2.0 - 4.0DC	9	14	0	1
More than 4.0DC	0	4	3	2

VISUAL ACUITY WITH FULL RETINOSCOPIC CORRECTION AT 3 MONTHS

	GOOD	SATISFACTORY	FAIR	POOR
Less than 2.0DC	36	18	0	0
2.0 - 4.0DC	13	10	0	1
More than 4.0DC	0	6	2	1

VISUAL ACUITY WITH SPHERICAL EQUIVALENT AT 3 MONTHS

	GOOD	SATISFACTORY	FAIR	POOR
Less than 2.0DC	32	21	1	0
2.0 - 4.0DC	11	11	1	1
More than 4.0DC	0	5	3	1

VISUAL ACUITY WITH BEST SUBJECTIVE CORRECTION AT 3 MONTHS

	GOOD	SATISFACTORY	FAIR	POOR
ICCE	53	38	4	2

KEY TO TABLE = SAME AS TABLE 3.

*** Similar trends were observed in both series.

TABLE 5a

CUMULATIVE COMPLICATIONS - ECCE

COMPLICATION	FREQUENCY	RELATIVE %
A. Intra-operative		
a. Hyphaema	10	3.47
b. Accidental rupture of posterior capsule	22	7.64
c. Zonular dehiscence	2	0.69
d. Vitreous loss	17	5.90
e. Iridodialysis	4	1.39
B. Immediate post-operative (0 - 3 days)		
a. Hyphaema	5	1.74
b. Striate keratopathy	78	29.10
c. Wound dehiscence with iris prolapse	2	0.69
d. Wound dehiscence without iris prolapse	1	0.35
e. Cystoid macular oedema	3	1.04
f. Elevated intra-ocular pressure	4	1.39
g. Severe uveitis	11	3.82
h. Abnormal pupil - drawn-up iris tissue	3	1.04
- torn iris tissue	2	0.69
i. Vitreous in anterior chamber	6	2.08
C. Early post-operative (4 days - 2 weeks)		
a. Endophthalmitis	1	0.35
b. Elevated intra-ocular pressure	4	1.39
c. Pupillary membrane	2	0.69
d. Cystoid macular oedema	5	1.74
e. Significant amount of keratic precip's	9	3.13
f. Posterior vitreous detachment	1	0.35
D. Late post-operative (2 weeks +)		
a. Elevated intra-ocular pressure	0	0.00
b. Opacification of posterior capsule	13	4.51
c. Keratopathy (corneal 'dystrophy')	4	1.39
d. Retinal detachment	0	0.00
e. Iris atrophy (moderate - severe)	58	21.64
f. Ocular mal-alignment	1	0.35

TABLE 5b

CUMULATIVE COMPLICATIONS - ICCE

COMPLICATION	FREQUENCY	RELATIVE %
A. Intra-operative		
a. Hyphaema	8	2.45
b. Accidental rupture of anterior capsule	19	5.81
c. Vitreous loss	33	10.09
d. Iridodialysis	7	2.14
B. Immediate post-operative (0 - 3 days)		
a. Hyphaema	3	0.92
b. Striate keratopathy	48	15.74
c. Wound dehiscence with iris prolapse	4	1.22
d. Wound dehiscence without iris prolapse	0	0.00
e. Cystoid macular oedema	6	1.83
f. Elevated intra-ocular pressure	9	2.75
g. Severe uveitis	2	0.61
h. Abnormal pupil - drawn-up iris tissue	21	6.42
- torn iris tissue	6	1.83
i. Vitreous in anterior chamber	30	9.17
C. Early post-operative (4 days - 2 weeks)		
a. Endophthalmitis	0	0.00
b. Elevated intra-ocular pressure	2	0.61
c. Pupillary membrane	0	0.00
d. Cystoid macular oedema	12	3.67
e. Posterior vitreous detachment	7	2.14
f. Significant amount of keratic precip's	3	0.92
g. Vitreous in anterior chamber	20	6.56
D. Late post-operative (2 weeks +)		
a. Elevated intra-ocular pressure	2	0.61
b. Keratopathy (corneal 'dystrophy)	1	0.31
c. Retinal detachment	1	0.31
d. Iris atrophy (moderate - severe)	45	14.75
e. Ocular mal-alignment	0	0.00
f. Vitreous in anterior chamber	16	5.25

TABLE 6

DURATION OF POST-OPERATIVE HOSPITAL STAY = (In Days)

A. OVERALL, FOR THE TWO CENTERS

	0 - 3	4 - 5	6 - 7	More than 7
ECCE	29	19	42	10
ICCE	39	18	35	8

B. CENTER I

	o - 3	4 - 5	6 - 7	More than 7
ECCE	0	4	39	9
ICCE	0	6	33	8

C. CENTER II

	0 - 3	4 - 5	6 - 7	More than 7
ECCE	29	15	3	1
ICCE	39	12	2	0

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APPENDIX

PROFORMA

STUDY NUMBER_____ PROSPECTIVE____ RETROSPECTIVE____

NAME_____ AGE_____ SEX___ I.P.No._____

STATION OF OPERATION_____

DATE OF ADMISSION_____ DATE OF OPERATION_____ DATE OF DISCHARGE_____

1. Any relevant medical history NO_____

YES_____a.systemic (specify)_____

b.ocular (specify)_____

Any relevant medication NO_____

YES_____a.systemic (specify)_____

b.ocular (specify)_____

2.PRE-OPERATIVE ASSESSMENT.

a.Visual acuity RE 6/60+___ CF___HM___ PL___ Projection____

LE 6/60+___ CF___HM___ PL___ Projection____

b.Intra-ocular pressure ____mm Hg.

c.Cornea normal RE YES___/ NO___ (specify)_____

LE YES___/ NO___ (specify)_____

d.Anterior chamber normal RE YES___/ NO___ (specify)_____

LE YES___/ NO___ (specify)_____

e.Morphology of cataract in eye for operation.

CORTICAL__ NUCLEAR__ PSC__ MIXED__ OTHER__ (specify)_____

f.Fundus (if visible) RE normal YES___/ NO_(specify)_____

LE normal YES___/ NO___ (specify)_____

g.Any other remarks_____

3.INTRA-OPERATIVE EVALUATION.

***Side of operation RE___ LE___

a.Technique ECCE____ ICCE____

b.Surgical complications NO___ / YES___ (specify)_____

c.Sutures -- Type_____ Number____

d.Any other remarks_____

4. POST-OPERATIVE ASSESSMENT 3/7.

a. Visual acuity___+10DS.___+11DS. Best visual acuity___ +___DS.

b. Intra-ocular pressure____mm Hg.

c. Ocular alignment ortho___ exotropia___ esotropia_____

d. Wound intact YES___ / NO___(specify)_____

e. Cornea normal YES___/ NO___(specify)_____

f. Anterior chamber normal YES___/ NO___(specify)_____

g. Pupil normal YES___/ NO___(specify)_____

h. State of anterior vitreous face In wound____ Ant. to pupil____
In pupil____ Post. to pupil____

i. Fundus normal YES___/ NO___(specify)_____

j. Any other findings_____

5. POST-OPERATIVE ASSESSMENT 6-8 weeks.

a. Visual acuity___+10DS. ___+11DS. ___ with +___DS (best corr. at (4

b. Intra-ocular pressure___mm Hg.

c. Ocular alignment ortho___ exotropia___ esotropia___

d. Anterior segment normal YES___/ NO___(specify)_____

e. Fundus normal YES___/ NO___(specify)_____

f. Any other findings_____

g. Retinoscopic refraction ___SPH.___CYL___AXIS___

Corrected VA with (g) Distance VA____ Near VA____

Corrected VA with sphere of (g) alone Distance VA____ Near VA____

Corrected VA with spherical equivalent Distance VA____ Near VA____

6. POST-OPERATIVE ASSESSMENT 3 MONTHS.

a. Patient's correction_____

Corrected VA_____ RE/LE

Cause of low VA if worse than 6/18_____

b. Gonioscopic findings in operated eye_____

7. POST-OPERATIVE ASSESSMENT 6 MONTHS+ (OPTIONAL).

a. Visual acuity (best corrected)_____ RE'LE

b. Cause of low visual acuity if less than at 3 months_____

c. Any new (late) complications_____

8. TOTAL FOLLOW-UP PERIOD_____