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Ocutome lensectomy: results and complications

R V Pearson, G W Aylward, R J Marsh

Abstract

We describe the results and the complications encountered in 69 lensectomies performed via a limbal approach with the Ocutome vitrectomy instrument, in which it was the intention at surgery to maintain the integrity of the posterior capsule. After operation 87% improved in visual acuity, and 68% achieved 6/12 or better. The main early complications encountered were perioperative rupture of the posterior capsule and iris damage. The main late complications were postoperative thickening of the posterior capsule, retinal detachment, and bullous keratopathy. Of the eyes in which the posterior capsule remained intact after operation 17% developed thickening of the posterior capsule to a degree that required capsulotomy over a mean follow-up period of 50 months.

In the past, congenital cataracts were treated surgically by such procedures as optical iridectomy, discission ('needling'), Ziegler through-and-through discission, intracapsular extraction, and linear extraction.[1-5] The results were often so poor, or the rate of complications so high, that many surgeons favoured a conservative approach.[1 5 6]

Scheie *et al*[7 8] reintroduced the aspiration technique for congenital cataracts and soft cataracts of any aetiology in individuals under 30 years of age (before the nucleus is firmly formed). In their procedure the posterior capsule remained intact at the end of the initial operation and was only surgically opened at a later date if it became so opaque as to interfere with vision. The vitreous was therefore minimally disturbed by the inital procedure. This saw a significant reduction in the number of complications, in particular retinal detachment. It is a relatively simple technique performed with inexpensive equipment, but does have the disadvantages that it has frequently to be followed by a number of operations to clear opacities from the posterior capsule,[9-12] cannot be employed with hard cortical and nuclear material,[13] and the correct management of vitreous loss is difficult with the incision and instruments used.[14]

With the introduction of vitreous infusion suction cutters lensectomy became possible, as lens matter could be cut as well as sucked. It was originally described as an operation in which the whole lens, including the anterior and posterior capsules, was removed. It can be performed via a limbal[15] or pars plana (or plicata)[16] approach, and the posterior lens capsule can be directly removed, left intact, or a fine needle capsulotomy performed at the end of the primary procedure.

The advantages of the anterior or limbal approach include better visualisation of instruments, the ability to perform a sphincterotomy before lensectomy in eyes with small pupils, and the use of small incisions which reduce the risk of vitreous loss, iris prolapse, and flattening of the anterior chamber during and after surgery and allow for rapid wound healing with earlier fitting of contact lenses.[17] Other advantages include the ability to preserve the posterior capsule and leave the vitreous undisturbed, but its chief advantage is the avoidance of damage to the retina (that is, dialyses and tears) by the introduction, withdrawal, and manipulation of instruments. Its main disadvantage is that fluid flow over the endothelium may be excessive.

The pars plana or plicata approach on the other hand avoids direct manipulation of, and a large volume of fluid flow across, the corneal endothelium and iris, and it allows immediate removal of lens particles which may fall into the vitreous.[16 18] However, dialyses and tears of the peripheral retina are a real risk adjacent to the entry sites, and incidences as high as 37% have been reported.[19] As there is no developed pars plana for the first few months of life, careful placement of the instrument probes is required to avoid a traumatic retinal detachment or ciliochoroidal detachment by infusion into the suprachoroidal space. The possibility of these complications has made the anterior approach through the limbus or cornea the usual one in infancy.[9]

Taylor[9] compared aspiration, in which the posterior capsule was left intact, and lensectomy, in which it was removed, in the treatment of congenital cataract. Following aspiration 19 of 28 eyes required repeated capsulotomy to maintain the pupillary area clear for refraction, while none were required following lensectomy. In a recent larger series the incidence of secondary procedures, most commonly a posterior capsulotomy, was higher in the group of eyes which had lens aspiration than in those which had lensectomy.[20] However, the incidence of postoperative posterior capsular opacification can vary with technique of extraction, age, and cataract aetiology, and indeed even the absence of the posterior capsule does not guarantee against secondary growth of lens epithelium, which may obstruct the visual axis.[21] Most authors[6 9 22] advocate a primary posterior capsulotomy or capsulectomy for surgery in the first year of life.

In lensectomy with rupture or removal of the posterior capsule the anterior vitreous is disturbed or damaged, and the effect of this on the postoperative incidence of retinal detachment is at present unknown. However, Shapland[23] and Cordes[24] found that, the more the vitreous was disturbed, the greater was the incidence of late retinal detachment following discission and linear extraction. Although unproved, leaving the posterior capsule intact should result in a

Western Ophthalmic Hospital, Marylebone Road, London NW1
R V Pearson
G W Aylward
R J Marsh

Correspondence to:
R V Pearson, Moorfields Eye Hospital, City Road, London EC1V 2PD.

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reduction in the incidence of retinal detachment. In addition, perioperative damage to the retina is avoided, strands of vitreous to the wound are eliminated, the anterior vitreous face remains intact, and so the incidence of cystoid macular oedema may be reduced;[25-27] and, if glaucoma filtration surgery is required at a later stage, it will not be hampered by vitreous in the anterior chamber. Further, an intact posterior capsule allows a greater flexibility in choice of secondary intraocular lens implant, and, should the posterior capsule opacify, the trend from surgical to YAG laser capsulotomy has made its treatment less invasive.

Lensectomy has been proposed for the treatment of complicated cataracts secondary to uveitis.[17 28-33] Small pupils due to posterior synechiae can be enlarged, particularly in Still's disease, and, in the presence of chronic uveitis, some consider that the posterior capsule[28 29] and anterior vitreous[30 31] should be removed. A potential scaffold for future inflammatory membrane formation is thus removed and capsular thickening and the need for capsulotomy obviated. Others, using phacoemulsification, have achieved excellent visual results while maintaining an intact, but vigorously scraped, posterior capsule.[32]

The instruments used for lensectomy were originally designed for vitreous surgery.[34-36] The Ocutome became available in 1975 and we prefer it because of the common-(20)-gauge separate infusion and cutting probes, guillotine cutting action, reliability, adjustability, and overall simplicity.[37 38] In use the small incisions and separate infusion facility help to keep the intraocular environment steadier without leaks or excessive fluid flow through the eye. In successful cases only 5 ml of infusion fluid is required and often as little as 2·5 ml.

The Western Ophthalmic Hospital acquired one of the first Ocutomes in the United Kingdom and began lensectomy in 1977. We considered that using the Ocutome and employing a limbal approach with preservation of the posterior capsule had both practical and theoretical advantages over alternative techniques for the surgical management of cataract suitable for lensectomy. This series describes the results obtained and the complications encountered in 69 lensectomies performed in this way.

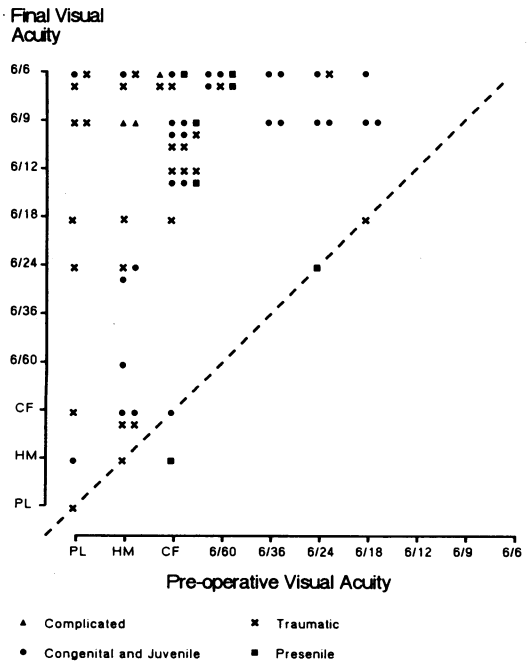

Figure Relation of final to preoperative visual acuity.

Patients and Methods

One hundred and eight lensectomies were performed at the Western Ophthalmic Hospital over an eight-year period between July 1977 and October 1985. A retrospective study was performed with reference to the visual results obtained and the incidence of perioperative and postoperative complications. All information was obtained from the patients' hospital records. Cases were excluded for the following reasons: (1) previous intraocular surgery other than primary repair; (2) penetrating trauma involving the posterior segment, so eliminating the possibility of confusing the complications of these events with those of the lensectomy procedure itself; (3) cases where satisfactory follow-up was not available; (4) surgery performed with instruments other than the Ocutome.

The study group comprised 69 eyes (58 patients). Eleven patients had surgery performed on both eyes at different times. Thirty six patients were male and 22 were female, aged 1 to 65 years, mean 23 years. The period of follow-up ranged from 2 to 98 months, mean 50 months.

The cause of cataract in the 69 eyes studied was as follows: three eyes had complicated cataracts secondary to uveitis (including one with Reiter's syndrome); 32 eyes had congenital or juvenile cataract (including 1 associated with optic atrophy, 2 congenital dominant cataracts, and 2 associated wth retinopathy of prematurity); 27 cataracts were traumatic, 3 due to blunt and 24 due to penetrating trauma; 7 were presenile cataracts (including 4 myopic eyes). In 3 eyes cosmesis was the main indication for surgery, though it was expected that some improvement in visual field was to be achieved and possibly some enhancement of peripheral fusion, which may reduce the tendency towards strabismus.[39-41]

OPERATIVE TECHNIQUE

All surgery was performed under general anaesthesia, following maximal pupillary dilatation.

A fixation knot manufactured from a 7·0 silk suture on a spatula point needle, inserted through superficial sclera 3 mm behind the limbus, was found useful for stabilisation of the eye when removing and introducing instruments. Stab incisions were made with an Ocutome stab blade at the temporal and nasal limbus. The anterior lens capsule was incised with the blade and hardness of the lens nucleus was then assessed by the ability of the knife to penetrate it. Failure, indicating too hard a nucleus for lensectomy, was followed by conversion of the operation to an extracapsular extraction. A separate infusion with a bent 20 gauge needle attached to a reservoir was inserted via the nasal stab incision.

Cortical lens matter was both directly aspirated and/or cut, the decision depending on the facility of aspiration. It was found inadvisable to engage and aspirate too much lens matter at once.

Results

VISUAL ACUITIES

The figure shows the preoperative to final visual acuity change. Only nine eyes (13%) had a preoperative visual acuity of better than 6/36. Forty seven eyes (68%) had a final acuity of 6/12 or better. In 60 eyes the visual acuity was improved, in five it was unchanged, and in one it was worse.

COMPLICATIONS (Table)

Early complications

Perioperative rupture of the posterior capsule occurred in 21 eyes (30%). The relative risk of its occurrence was 1·88 in those with presenile cataracts compared with overall ($z_c=5·42$, $p<0·001$). In one eye capsular rupture led to dislocation of the lens nucleus into the vitreous, which was immediately retrieved with the Ocutome.

Damage to the iris from accidental inclusion in the port of the Ocutome occurred in eight eyes. This produced minor cosmetic defects only.

The commonest postoperative complication was the presence of residual soft lens matter in the anterior chamber. The incidence of this was greater in the subgroup of traumatic cataracts. It was not associated with a reduction in visual acuity or an increased incidence of thickening of the posterior capsule.

Total hyphaema occurred in two eyes. One complicated cataract with extensive posterior synechiae showed complete resorption and a final visual acuity to 6/9. The other with cataract and disorganised anterior chamber secondary to penetrating trauma suffered organisation to form a fibrotic pupillary membrane, reducing the final visual acuity to perception of light. Bleeding from the iris was due to rupture of adhesions between it and other ocular structures which had formed secondary to trauma or inflammation.

Late complications

Postoperative iritis recurred throughout a two-year follow-up in only one of three eyes with complicated cataract.

Retinal detachment occurred in two eyes postoperatively. One, with a dialysis in an eye with an intact posterior capsule, was detected two days after surgery for a cataract secondary to blunt trauma in a 34-year-old male. Successful detachment surgery resulted in a final visual acuity of 6/9. It is possible that this detachment was caused by the preceding trauma. The second occurred 13 months after lensectomy for a presenile cataract in a 46-year-old male, complicated by rupture of the posterior capsule and dislocation of the lens nucleus into the vitreous and its retrieval with the Ocutome. The retina, with lattice degeneration and atrophic holes, was flattened at surgery, but the acuity did not improve beyond hand movements.

Eight eyes developed opacification of the posterior capsule which required capsulotomy. Five of these, with a mean age of 20 years and range 10 to 31 years, were in the subgroup of congenital and juvenile cataracts. Final visual acuities were 6/9 or better in all eyes after surgical capsulotomy, and no eye required a repeat procedure. Three eyes underwent lensectomy, with preservation of the posterior capsule, for complicated cataract. None developed capsular thickening sufficient to require capsulotomy, and all had final visual acuities of 6/9 or better.

Bullous keratopathy ensued in two eyes. One occurred four years after lensectomy for a presenile cataract with a hard lens nucleus, necessitating its prolonged manipulation in the anterior chamber at surgery, resulting in endothelial damage. In the second eye corneal oedema did not clear after lensectomy in an eye with a cataract and leucoma adherens secondary to penetrating trauma in which the endothelium was noted to be compromised at the following primary repair.

Glaucoma developed postoperatively in two eyes. It was steroid induced in one eye with a complicated cataract and recurrence of iritis. In an eye with a juvenile cataract it occurred in presence of an open angle, unassociated with any pre- or postoperative complications and was successfully controlled with topical therapy. Both eyes have final visual acuities of 6/5.

OPTICAL CORRECTION

Aphakia was initially corrected with contact lenses in 45 eyes (65%). Later nine of these 45 eyes become intolerant. Aphakic spectacles were used in 10 eyes (14%) initially and 16 eyes (23%) finally. Four myopic eyes achieved emmetropia, and 10 eyes initially and 13 eyes finally were ametropic and optically uncorrected. Five eyes were unable to benefit from their improved visual potential owing to contact lens intolerance

Table Numbers of complications

Complication	*Cataract type*				
	Complicated	*Congenital and juvenile*	*Traumatic*	*Presenile*	*Total*
Early complications					
Posterior capsule rupture	–	5	13	4	21
Iris damage	–	5	3	–	8
Loss of lens material to vitreous	–	–	–	1	1
Dislocation of lens nucleus to vitreous	–	–	–	1	1
Hyphaema	1	–	1	–	2
Residual lens matter in AC	–	1	9	1	11
Total	1	10	26	7	44
Late complications					
Retinal detachment	–	–	1	1	2
Glaucoma	1	1	1	–	2
Posterior capsule thickening iritis	–	5	1	2	8
Bullous keratopathy	1	–	–	–	1
Pupillary membrane	–	–	1	1	2
Total	–	–	1	–	1
	2	6	5	4	16

in a unilaterally aphakic eye. None of the eyes in this study had a secondary intraocular lens inserted during the follow-up period.

Discussion

Lensectomy through the limbus for juveniles and young patients with cataract proved to be a safe and successful operation. We preferred to preserve the posterior capsule if possible in all cases and achieved this in 70%. Only 17% of these required a posterior capsulotomy.

Leaving the posterior capsule intact avoids perioperative damage to the retina and causes minimal disturbance to the vitreous, eliminates strands of vitreous to the wound, and minimises and theoretically should eliminate lens matter falling into the vitreous. As secondary implantation of an intraocular lens may be increasingly considered at a later date in these eyes, this is a further indication for attempting to maintain the integrity of the posterior capsule, so increasing the safety of implantation and flexibility in choice of secondary intraocular lens. Indeed hopes for the future could include the development of flexible intraocular lenses inserted through the bore of 20 gauge instruments at the primary procedure and perhaps their removal and replacement by the same route to correct a change of refraction.

The main problem of leaving the posterior capsule intact, which has been well documented following aspiration[10-12] and phacoemulsification,[42] has been the high frequency, degree, and rapidity of its subsequent opacification. However, in our series leaving the posterior capsule intact, even in cases of congenital, juvenile, and complicated cataract, was followed by a low incidence of capsular opacification. Note should, however, be made of the lower mean age of the patients in the studies of Taylor *et al*,[9 20] since postoperative thickening of the posterior capsule has been noted to occur more frequently and to develop more quickly in infancy[9] and particularly in juvenile chronic arthritis.[17]

If the posterior capsule does opacify, a posterior capsulotomy can now be performed, even in young patients with a YAG laser. The introduction of vertically aimed versions of these means that this treatment is becoming available to very young patients as a secondary procedure under a general anaesthetic.

We believe that lensectomy through the limbus is superior to the pars plana or plicata approach because it allows better visualisation of instruments, enables a sphincterotomy to be performed before lensectomy in eyes with small pupils, allows preservation of the posterior capsule and therefore causes minimal disturbance to the vitreous, and avoids damage to the peripheral retina by the introduction, withdrawal, and manipulation of and infusion through instruments.

Disadvantages and complications of lensectomy that have been described include failed lensectomy, loss of lens material into the vitreous, vitreous loss, vitreous haemorrhage, iris bleeding, iris damage, retinectomy, striate keratitis, retinal detachment, secondary pupillary membrane formation, and corneal endothelial damage. The main disadvantage of lensectomy is the unsuitability of the technique for removal of lenses with hard nuclei[17] and the large number of complications that occur when this is attempted.[13] Additional complications that we encountered include perioperative rupture of the posterior capsule and postoperatively the presence of residual soft lens matter in the anterior chamber, raised intraocular pressure, and recurrence of iritis.

We noted two retinal detachments in our patients. Although the first may have been caused by preceding blunt trauma, the second followed considerable manipulation of the vitreous to remove a dislocated lens nucleus, and we do know from earlier observations that the incidence of retinal detachment is higher if the vitreous is disturbed.[23 24] Since retinal detachment has been reported as late as 33 years after congenital cataract surgery,[23 43-46] a follow-up of this duration will be required to determine whether Ocutome lensectomy via an anterior approach with attempted preservation of the posterior capsule is associated with a lower (or higher) incidence of retinal detachment than that reported as following other operative techniques.[23 47-50]

Endothelial damage and bullous keratopathy occurred when it was attempted to remove a cataract with a hard nucleus, necessitating its prolonged manipulation in the anterior chamber at surgery. The occurrence of this complication reflects bad case selection, and ways to avoid it include not attempting lensectomy on eyes with hard nuclei (that is, nuclear sclerosis) and assessing the degree of hardness of the lens nucleus preoperatively and converting to an extracapsular extraction if indicated. Similarly, the higher incidence of perioperative rupture of the posterior capsule in the subgroup of presenile cataracts could be reduced in the same way.

The treatment of choice for a cataract with any significant nucleus is extracapsular cataract extraction or phacoemulsification. Phacoemulsification has the advantage of a small (3 mm) incision, and with skillful handling can deal with quite dense nuclei. From the point of view of case selection patients under 30 years should perhaps be considered for lensectomy, as the incisions are smaller than for phacoemulsification, less fluid is infused through, and the instruments are not so difficult to manoeuvre in the eye. At age 30 or more elective phacoemulsification or extracapsular extraction are probably more appropriate.

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