

The management of dislocated lens material after phacoemulsification

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Abstract

Purpose To determine the visual outcome, prognostic factors, and effect of timing of surgical intervention in patients with retained lens fragments after phacoemulsification.

Methods A retrospective review was carried out of the notes of 44 consecutive patients who suffered posterior dislocation of lens fragments during phacoemulsification, of whom 34 underwent vitrectomy.

Results The presence of severe uveitis at presentation was a significant predictor of a final visual acuity of less than 6/60 ($p = 0.002$). A raised intraocular pressure at presentation (> 29 mmHg) significantly increased the risk of chronic glaucoma ($p = 0.0279$), but there was no association between glaucoma and delay in vitrectomy. Patients operated on within 1 week of cataract surgery obtained a better visual outcome (64.7% of patients achieved 6/12 or better visual acuity) than those operated on later than 1 week (41% obtained 6/12), but this difference did not reach statistical significance.

Conclusions The trend towards a better visual outcome with early vitrectomy was not statistically significant. A large prospective trial is indicated to determine the optimum time for vitrectomy in these patients.

Key words Glaucoma, Lens, Nucleus, Phacoemulsification, Vitrectomy

The popularity of phacoemulsification has greatly increased in recent years and it has now become the surgical technique of choice for many cataract surgeons. There is evidence, however, that this technique is associated with an increased incidence of dislocation of crystalline lens fragments into the posterior segment when compared with extracapsular cataract extraction, particularly during the learning curve.¹⁻³

Patients with retained intravitreal lens material usually have reduced visual acuity and a significant panuveitis, which may be severe enough to simulate microbial endophthalmitis.⁴ Corneal oedema, raised intraocular pressure

and macular oedema are common, and up to 10% of patients will have a retinal detachment at the time of referral to a vitreoretinal specialist.⁵⁻⁷

Whilst dislocation of lens fragments is an uncommon complication of phacoemulsification it is a potentially serious one, because a significant proportion of patients will experience a poor visual outcome. The proportion with a final visual acuity of 6/60 or less has been reported to be between 10% and 37%.⁵⁻⁸ Poor vision in these patients may be attributable to retinal detachment, chronic glaucoma or cystoid macular oedema. Well-intentioned attempts to remove the dislocated lens at the time of cataract surgery via an anterior approach may actually increase the risk of complications and result in a poor visual outcome.⁶

The use of pars plana vitrectomy in the management of dislocated lens fragments was reported by Hutton and co-workers in 1978.⁹ This has now become the accepted technique for the removal of retained lens fragments, and it has been suggested that vitrectomy should be performed even if only a very small fragment of lens material remains in the vitreous cavity. Several authors have advocated early vitrectomy and removal of lens fragments, citing an increased risk of chronic glaucoma if surgery is postponed for more than 3 weeks.^{5,6} The aim of early intervention is to remove the lens matter before phacoanaphylaxis or lens particle glaucoma set in, some of the consequences of which may be irreversible. The rationale for delay is to await the development of a posterior vitreous detachment and, possibly, some degree of 'softening' of the lens matter to facilitate removal with a vitreous cutter.

A retrospective review of cases seen at Moorfields Eye Hospital over a 4 year period was carried out in order to quantify visual results and identify risk factors for a poor visual outcome.

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Patients and methods

For this study we performed a retrospective review of the notes of 44 consecutive patients with retained crystalline lens fragments in the posterior segment following phacoemulsification. To estimate the incidence of dislocation of lens fragments into the vitreous cavity during cataract surgery by phacoemulsification we reviewed the notes of all those patients noted in the theatre records to have suffered a rupture of the posterior capsule with vitreous loss at Moorfields between 1 January 1991 and 31 January 1995.

For each patient the following data were recorded: the type and quantity of lens material lost at the time of phacoemulsification; the visual acuity, and the presence of corneal oedema, uveitis, glaucoma and retinal detachment at presentation; the timing and nature of any vitreo-retinal surgical intervention; the final visual acuity; and the reasons for a poor visual outcome where appropriate.

The decision to perform vitrectomy, the timing of this surgery and the exact surgical technique employed were at the discretion of individual surgeons. When removal of dislocated lens matter was deemed necessary a three-port pars plana vitrectomy was performed in all cases. Initially the cataract wound was inspected and reinforced with interrupted 10-0 nylon sutures where necessary. Dislocated lens matter was removed using the vitreous cutter where possible. Nuclear material was floated clear of the retina with perfluoro-*n*-octane¹⁰ and then either emulsified with the fragmatome in the mid-vitreous cavity or delivered via a corneal incision or scleral pocket.

After removal of lens fragments the vitrectomy was completed and the peripheral retina examined for retinal tears. Retinal breaks were treated by retinopexy and internal tamponade.

Risk factor analysis was performed using the chi-squared test. Logistic regression analysis was then employed to test each potential risk factor as independent variable for its ability to predict a poor visual outcome and the presence of raised intraocular pressure at the final follow-up visit.

Results

Of 193 patients who suffered a rupture of the posterior capsule with vitreous loss during phacoemulsification, 32 were identified in whom dislocation of lens material occurred (16.6%). In addition 12 patients were studied who were referred to the vitreo-retinal surgical service at Moorfields from surgeons at other institutions for management of lost lens fragments during the same period. The original cataract surgery had been performed by all grades of surgeon from Senior House Officer to Consultant. The mean age of the 44 patients was 68 years (range 20–87 years). The mean follow-up interval from the time of phacoemulsification was 6.52 months (range 1–26 months), one patient having died 1 month after surgery.

Table 1. Clinical features at presentation (n = 40)

	No.	(%)
Visual acuity		
Better than 6/18	5	(13)
6/18 to 6/60	14	(35)
Worse than 6/60	21	(52)
Corneal oedema	28	(70)
Glaucoma (IOP > 29 mmHg)	24	(60)
Significant inflammation	29	(73)
Vitreous haemorrhage	3	(8)
Retinal detachment	1	(3)

At the time of phacoemulsification 27 patients had a posterior chamber intraocular lens implanted, 3 patients received an anterior chamber implant and 14 patients were left aphakic. There was a trend towards a better final visual acuity in those patients in whom a posterior chamber intraocular lens was implanted at the time of cataract surgery, but this did not achieve statistical significance ($p = 0.199$). The retained lens matter was identified on the basis of the operative notes as being nuclear in origin in 30 cases and epinucleus or soft lens matter in 14.

Clinical features of patients with retained lens matter

Four patients underwent immediate vitrectomy at the time of their original cataract surgery. The clinical features of the remaining 40 patients at the time of presentation are summarised in Table 1. The presenting visual acuity was less than 6/60 in 21 cases (52%). Raised intraocular pressure, defined as an intraocular pressure of greater than 29 mmHg or a pressure that required to be controlled with anti-glaucoma medication, was present in 24 patients (60%). One of these patients had pre-existing glaucoma at the time of phacoemulsification.

Presence of intraocular inflammation

Significant intraocular inflammation (at least one 'plus' of cells in the anterior chamber) was recorded in 29 patients (73%) and a marked uveitis (three 'plus' of cells) in 7 of these. Three patients presented with a hypopyon and inflammation sufficient to mimic microbial endophthalmitis, but in none of these cases was there any evidence of micro-organisms on microscopy or culture of the vitrectomy specimens. These 3 patients all suffered a poor outcome despite urgent vitrectomy and intravitreal antibiotics. One patient eventually had the affected eye

Table 2. Surgical management of dislocated lens material (n = 34)

	No.	(%)
Fragmatome	16	(47)
Perfluorocarbon liquids	18	(53)
Nucleus delivered via corneal section	6	(18)
Laser photocoagulation or cryotherapy	10	(29)
Air/SF ₆ /C ₃ F ₈ gas/silicone oil	9	(26)
Scleral buckle	3	(9)
Intraocular lens implanted	4	(12)
Intraocular lens removed	2	(6)
Intravitreal antibiotics	3	(9)

Table 3. Comparison of 'early' and 'late' vitrectomy

	No.	(%)
<i>Final visual acuity 6/12 or better</i>		
Early	11/17	(65)
Late	7/17	(41)
No surgery	9/10	(90)
Total	27/44	(61)
<i>Presence of chronic glaucoma</i>		
Early	5/17	(29)
Late	3/17	(18)
No surgery	3/10	(30)
Total	11/44	(25)
<i>Post-operative retinal detachment</i>		
Early	2/17	(12)
Late	4/17	(24)
Total	6/34	(18)

eviscerated, 1 was left with perception of light and 1 with no perception of light. The presence of a marked uveitis was significantly associated with a final visual acuity of less than 6/60 (chi-squared $p = 0.002$; multiple logistic regression analysis: odds ratio 11.23, 95% confidence interval 1.3–96.6).

Surgical management

The surgical management of the 34 patients who proceeded to vitrectomy is summarised in Table 2. The interval between phacoemulsification and vitrectomy ranged from the same day to 3½ months. Four patients underwent immediate vitrectomy and a further 13 had vitrectomy within 1 week of cataract surgery ('early' vitrectomy). Seventeen patients had a vitrectomy performed more than 1 week after phacoemulsification ('late' vitrectomy). In 10 patients, 9 of whom had only

soft lens matter or epinucleus in the vitreous cavity, further surgical intervention was deemed unnecessary. The group undergoing vitrectomy consisted of 29 patients with retained nuclear material and 5 with retained soft lens matter. Retained nuclear material was delivered via a corneal or scleral section in 6 cases and emulsified with a fragmatome in a further 16 cases. Where use of a fragmatome was deemed necessary it was used in low-power pulsed mode, in conjunction with perfluorocarbon liquids, to avoid retinal damage. One patient required repair of a pre-operative retinal detachment whilst in other cases retinal photocoagulation or cryotherapy (10 cases), gas or silicone oil tamponade (9 cases) and scleral buckling (3 cases) were performed for the management of pre-existing or iatrogenic intra-operative retinal tears. In 2 cases it was necessary to remove an intraocular lens implant to deliver lens matter. A posterior chamber intraocular lens was implanted or sutured in place following vitrectomy in 4 cases.

There was a trend towards a better final visual acuity in patients who underwent vitrectomy within a week of the original cataract surgery (Table 3, Fig. 1), but this did not reach statistical significance ($p = 0.106$). Of the 10 patients who did not require surgery 9 achieved 6/12 or better vision and the remaining patient had a final visual acuity of 6/60 due to cystoid macular oedema.

Raised intraocular pressure

A quarter of all patients had persistently raised intraocular pressure requiring anti-glaucoma medication at the final follow-up appointment. A raised intraocular pressure at presentation significantly increased the risk

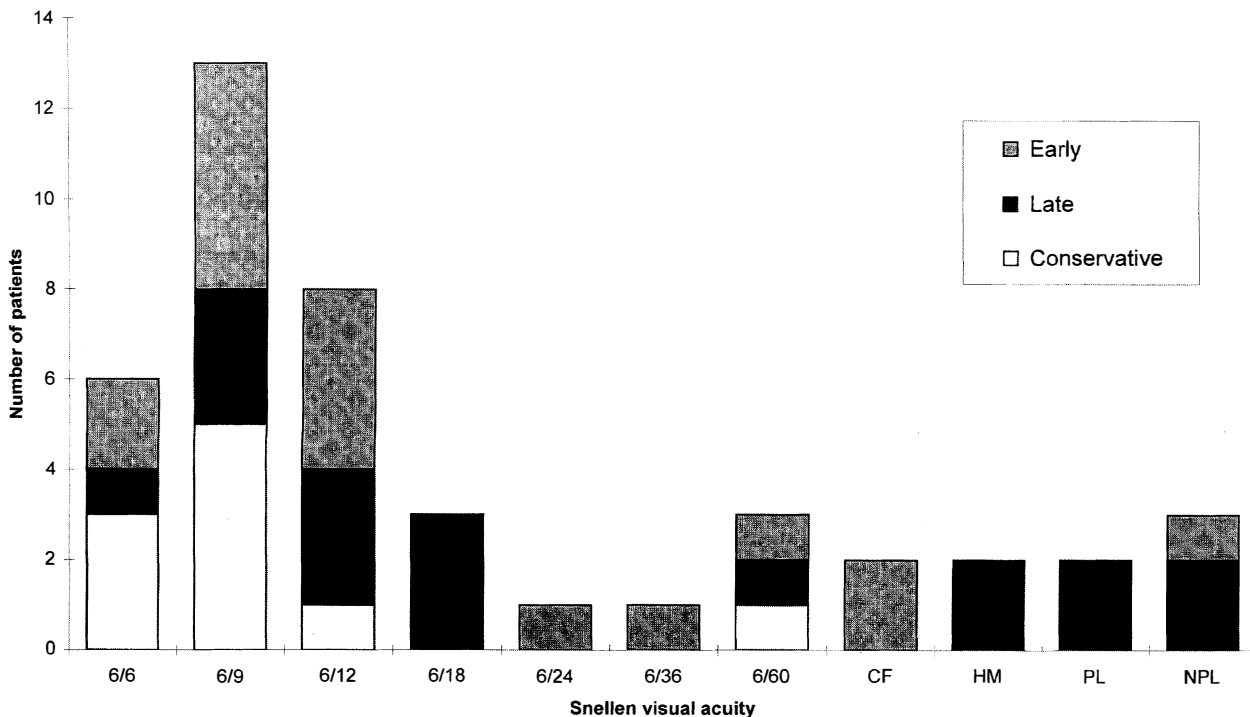


Fig. 1. Final visual acuity results: early or late vitrectomy and conservative management.

Table 4. Causes of poor visual outcomes

Retinal detachment	6
Chronic uveitis	3
Maculopathy	11
Cystoid macular oedema	6
Macular scar	2
Epiretinal membrane	2
Diabetic maculopathy	1

of chronic raised intraocular pressure in the study group as a whole ($p = 0.027$; odds ratio 6.67, 95% confidence interval 1.16–38.4).

Retinal detachment

The incidence of retinal detachment following vitrectomy was 18% overall. Poor visual outcomes were largely attributable to retinal detachment, chronic inflammation or maculopathy (cystoid macular oedema, macular scar, diabetic maculopathy), as presented in Table 4 and Fig. 2.

Discussion

There is no large series in the literature from which an accurate figure can be obtained for the incidence of dislocation of lens fragments during phacoemulsification. In this study, of 193 patients in whom vitreous loss was recorded to have occurred during phacoemulsification, 32 (16.6%) also suffered dislocation of lens matter into the posterior segment. Of these only 22 required vitrectomy (11.4%).

The relatively high incidence of corneal oedema, raised intraocular pressure and significant uveitis found at presentation in this series is comparable to that seen in previous studies.^{5–8,11–13} Three patients in our series presented with a hypopyon and intraocular inflammation severe enough to mimic late-onset microbial endophthalmitis. They all underwent vitrectomy soon after presentation, at 27, 34 and 95 days after phacoemulsification respectively. This manifestation of the presence of retained lens matter has been recorded in earlier studies.^{4,6,9} Since it is impossible to distinguish a sterile from an infectious endophthalmitis on clinical examination alone it is essential to perform an aqueous and vitreous tap for microscopy and culture in such cases. If there is a history of retained lens matter a full vitrectomy should then be performed, and if there is doubt regarding the diagnosis a pre-operative ultrasound scan may reveal the presence of pieces of lens nucleus in the vitreous cavity.⁴

Twenty-seven patients in our series had a posterior chamber intraocular lens implanted at the time of phacoemulsification. Implantation of a posterior chamber intraocular lens at the time of cataract surgery may obviate the need for a further surgical procedure, especially in those patients in whom vitrectomy is deemed unnecessary. If on the other hand a vitrectomy is required, the presence of an implant precludes delivery of the nucleus via a corneal section. Three studies have now shown that placement of an intraocular lens at the time of phacoemulsification does not adversely affect the final visual outcome,^{7,8,11} and one showed a trend towards an improved visual result.⁸

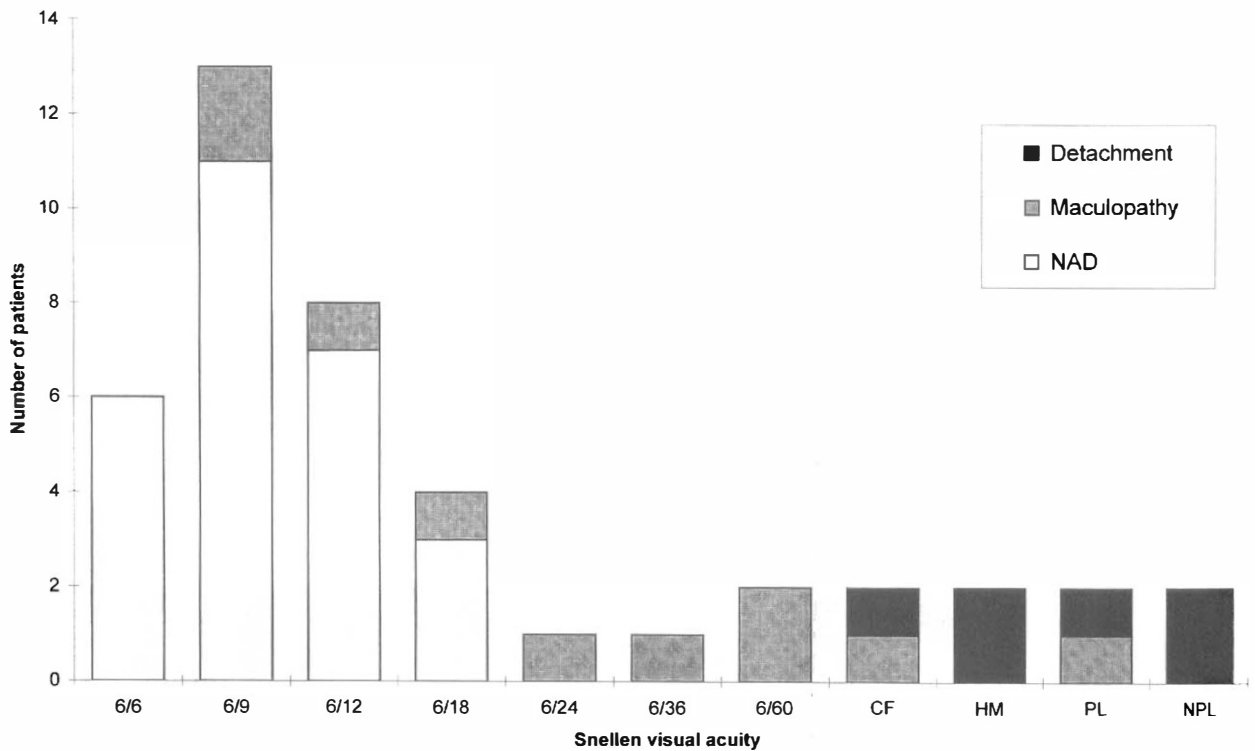


Fig. 2. Final visual acuity results: causes of poor visual outcome.

In this study 53% of patients undergoing vitrectomy achieved a final visual acuity of 6/12 or better. If those patients who did not require further surgery are included this figure rises to 61%. A significant proportion of patients (9/44 in the present series) may, however, be left with an acuity of less than 6/60.⁵ Some authors suggest that patients should undergo an early vitrectomy, citing a trend towards better visual results if surgery is performed within a week of phacoemulsification,^{8,11} whilst others favour postponing surgery until intraocular pressure and inflammation are adequately controlled.⁶ None of these authors was able to present statistically significant evidence to support their contention. The trend in the present study towards an improved visual outcome when vitrectomy was performed within a week of phacoemulsification did not reach statistical significance. Multiple logistic regression analysis of all the variables showed severity of uveitis to be the best predictor of final visual outcome. Whilst timing of vitrectomy was not an independent predictor of visual outcome, its effect would have been mediated by (and effectively masked by) intraocular inflammation.

The advent of perfluorocarbon liquids has probably been the most important advance in the management of retained lens fragments since the description of pars plana vitrectomy for this condition.⁹ In our series perfluorocarbon liquids were utilised to float the retained nuclear material through a corneal or scleral section in 6 cases and to enable it to be emulsified with the fragmatome in the mid-vitreous cavity, minimising the risk of iatrogenic retinal breaks, in a further 12. However, the incidence of post-operative retinal detachment was 18%. An adequate vitrectomy and careful examination of the retinal periphery after removal of lens material is recommended.

Two of the earliest studies suggested an increased risk of chronic glaucoma in patients whose vitrectomy was delayed beyond 9 days and 3 weeks respectively.^{5,6} In two larger and more recent series, however, there was no statistical evidence of such an association.^{7,8} In the present series the incidence of chronic raised intraocular pressure was associated with raised intraocular pressure at presentation, but unrelated to the length of time to vitrectomy.

In this series vitrectomy was deemed unnecessary in a group of 10 patients with soft lens matter or a small quantity of nuclear material in the vitreous cavity. There have been reports that even small retained lens fragments may lead to sight-threatening complications such as chronic glaucoma, uveitis and cystoid macular oedema,^{5,7} and indeed there were 3 cases of persistently raised intraocular pressure in this group. Despite this, 9 of these 10 retained a visual acuity of 6/12 or better. We would agree with those authors who feel that a patient with only a small amount of intravitreal lens matter may, in the absence of marked intraocular inflammation or uncontrollable glaucoma, be safely observed without recourse to early vitrectomy.¹²

In summary this study confirms that dislocation of crystalline lens fragments into the vitreous cavity is a potentially serious complication of phacoemulsification likely to affect the final visual outcome adversely. The presence of severe intraocular inflammation at presentation is associated with a much poorer outcome, and a raised intraocular pressure at presentation appears to predispose to chronic glaucoma. Clearly a randomised controlled clinical trial would be necessary to establish the indications for, and optimal timing of, removal of lens fragments. There are, however, considerable logistical problems in setting up such a trial. Statistical power calculations based on the above data show that a trial comparing immediate (within 1 week) with deferred intervention would require 100 patients in each arm. We currently see approximately one new case of retained lens matter each week, but many of these are referred after a period of observation and would be ineligible for such a trial. Our current practice is to perform early vitrectomy (within 1 week) for fragments greater in size than one-quarter of the nucleus and to observe smaller fragments, intervening if sight-threatening complications supervene.

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