

Paper

The incidence and rate of rhegmatogenous retinal detachment seven years after cataract surgery in patients with high myopia.

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Accepted 12 December 2008

ABSTRACT

Background: Cataract extraction is the most commonly performed surgery in the National Health Service. Myopia increases the risk of postoperative rhegmatogenous retinal detachment (RRD). The aim of this study was to determine the incidence and rate of RRD seven years after cataract extraction in highly myopic eyes.

Methods: Retrospective review was performed of notes of all high myopes (axial length 26.0 mm or more) who underwent cataract extraction during the study period in one centre.

Results: 84 eyes met the study criteria. Follow-up time from surgery was 93 to 147 months (median 127 months). The average axial length was 28.72 mm (sd 1.37). Two eyes developed post-operative RRD; the incidence was 2.4% and the rate one RRD per 441.6 person-years. The results of 15 other studies on the incidence of RRD after cataract extraction in high myopia were pooled and combined with our estimate.

Conclusion: Both patients in our study who developed RRD had risk factors for this complication as well as high myopia. Risk factors are discussed in the light of our results and the pooled estimate.

Our follow-up time is longer than most. Future case series should calculate rates to allow meaningful comparison of case series.

Keywords: Extracapsular cataract extraction, Myopia, Phacoemulsification rate, Retinal detachment

INTRODUCTION

Cataract extraction is the most commonly performed surgery in the United Kingdom's National Health Service¹ and in the United States². Features of cataract surgery such as short procedure times, day surgery and high success rates can lull patients into believing that it is a risk free procedure. However sight threatening postoperative complications exist, and the most common of these is rhegmatogenous retinal detachment (RRD)³. The normal lifetime risk of RRD in high myopia without surgery has been estimated to be 40 times the lifetime risk of RD in emmetropia⁴, and myopia also increases the risk of postoperative RRD⁵. The aim of this retrospective study was to determine our incidence and rate of primary or recurrent RRD following cataract extraction in highly myopic eyes, and to review pertinent risk factors in the light of our and others' experiences.

METHODS

All high myopes who had undergone cataract surgery in one centre (the Royal Group of Hospitals, Belfast, Northern Ireland {RGH}) between January 1995 and December 1999 inclusive were identified. Their electronic and written medical records in two ophthalmology units were examined retrospectively. The two centres were the RGH and Altnagelvin Area Hospital, Londonderry, Northern Ireland (AAH). High myopia was defined as an axial length of 26.0mm or more

as determined by A-scan biometry (Humphrey). Eyes with shorter axial lengths were not included. For patients who had cataract surgery in both eyes within the study period, only the first eye to have surgery was included. Eyes with a history of retinal detachment were excluded. The following details were recorded: sex; age; axial length; use of prophylactic laser photocoagulation; intraoperative and postoperative complications; intraocular lens (IOL) power and position and use of neodymium-doped yttrium aluminium garnet (Nd:YAG) laser capsulotomy. All patients had had a pre-operative assessment. Corneal curvatures were measured with a keratometer. A-scan biometry was performed and IOL power determined by the Sanders Retzlaff Kraff (SRK) II formula. All patients had postoperative education about the symptoms of a retinal tear or detachment. All cataract surgery was performed by consultants or experienced junior surgeons using similar techniques. There were at least two postoperative clinic visits per patient. The nature of any

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TABLE I.
Data on the cases of post-operative RRD

	Case 1	Case 2
Age at time of surgery (years)	47	59
Sex	Male	Male
Fellow eye	-3.5 D	Artificial Eye
Preoperative Myopia (D)	-7	-2.5DS / -1.0DC
Axial Length (mm)	29.02	26.92
History of previous RD	No	Yes (fellow eye)
IOL	+8D (posterior chamber)	+9D (posterior chamber)
Type of procedure	Phacoemulsification	Phacoemulsification
Intraoperative complications	None	Zonular dehiscence and vitreous prolapse
Time of RD post-cataract surgery	60 months	27 months
Nd-YAG laser for PCO	Yes	No
BCVA at final follow up	20/40	20/60

postoperative ophthalmic problems, which involved either laser or surgical procedures, was recorded. This study adhered to the guidelines of the Declaration of Helsinki.

A search was performed on Medline for studies published after 1993 on retinal detachment following cataract extraction in high myopia. Papers on clear lens extraction for refractive purposes were excluded. Information on the incidence of retinal detachment following extracapsular (ECCE: meaning extraction by nucleus expression) and phacoemulsification procedures was collated and pooled.

RESULTS

Eighty-four eyes met the study criteria. The average age at the time of cataract surgery was 69.35 years (s.d. 11.81; range 32 – 92 years). Twenty-two patients were male, 62 female. Median follow-up time from cataract surgery was 127 months (93 to 147 months). Six patients died during the follow-up period, a median of 96 months after cataract surgery (range 74 – 131 months). Two eyes had been excluded as they had a history of retinal detachment in the operated eye. Three eyes had a history of RRD in the fellow-eye: these were included. Prophylactic treatment of predisposing retinal lesions was not performed in any case. Phacoemulsification was performed in 71 cases and ECCE in 11 cases. Trabeculectomy was combined with phacoemulsification in one case, and trabeculectomy with ECCE was carried out in one case. The average axial length was 28.72mm (s.d. 1.37, range 26.50 – 32.11mm). The median power of the IOL used was +8 dioptres (D) (0.0D to +10D). (In one case, data on IOL strength was unavailable.) In two cases a capsular tear occurred intraoperatively, but no vitreous prolapse was noted and the IOL was in each case placed in the capsular bag. In one case vitreous was noted in the anterior segment intraoperatively (case two of RRD, described below). In one case iris prolapse was noted postoperatively: surgical repair was undertaken 20 days postoperatively. One eye had no lens implant at the time of surgery, but 76 months later had secondary implantation of a +10D lens in the posterior capsular bag. Due to postoperative high myopia, this lens was

exchanged for a +4D lens placed in the ciliary sulcus one week later. Thirty-two eyes underwent post-operative Nd-YAG posterior capsulotomy for posterior capsular thickening. The median time from cataract surgery to laser capsulotomy was 46 months (range 5 – 134 months).

Two of the 84 eyes developed post-operative RRD (table I). This represents a rate of one RRD per 441.6 person-years, or an incidence of 2.4%. Both cases with RRD were male, aged 47 years (case one) and 59 years (case two) at the time of cataract surgery.

In case one of RRD, uncomplicated phacoemulsification was performed and a +8D IOL placed in the posterior chamber. The axial length was 29.02mm. Posterior capsular thickening developed and 57 months following cataract surgery Nd-YAG laser posterior capsulotomy was carried out. Twelve shots of 2.3mJ were used. Three months following YAG laser treatment the patient bumped his head off a pillar, and developed floaters and photopsia the same day. He presented 2 days later with RRD associated with two horseshoe shaped tears. This was treated with cryopexy and application of a scleral buckle. Seventy-six months following RRD repair, the Snellen visual acuity in the eye was 20/30 with glasses and the patient was discharged from clinic.

Case two had a history of RRD in the fellow eye 19 years prior to the pertinent cataract operation. The fellow eye RRD had presented immediately following a slip, when the eye hit a chair. Two attempts were made to surgically repair the RRD, but these were unsuccessful and the eye became phthisical. The patient wore a cosmetic shell over this fellow phthisical eye. The other eye had an axial length of 26.92mm. During the phacoemulsification procedure a strand of vitreous was noted in the anterior segment immediately after placement of a +9D IOL in the capsular bag. This was thought to be due to zonular dehiscence. Anterior vitrectomy was not necessary, and when Miochol® (acetylcholine chloride) was applied, the pupil constricted satisfactorily and vitreous was no longer evident. Twenty-seven months later the patient presented with a superior bullous RRD. A posterior and a peripheral retinal

TABLE II.
Reported incidences of RD following lens extraction.

Author (yr of pub)	Phaco +/- IOL		ECCE +/- IOL				Age range (years)	Follow-up (months)
	N. of eyes	N. of RRDs	N. of eyes	N. of RRDs	Def. of myopia			
Alio ⁴ (07)	439	12(2.7%)	0	-	Ax.L. 26.0mm or more & SE -6.0D or more	21 - 90	2 - 147	
Allredge ⁵ (98)	80	0	0	-	-7.0D or more minus		9 - 77	
Badr ⁶ (95)	0	-	368	6(1.6%)	Ax.L. 26.0mm or more	30 - 86	6 - 86	
Fan ⁷ (99)	45	1(2.2%)	73	1(1.4%)	Ax.L. 26.0mm or more	29 - 84	12 - 89	
Jacobi ⁸ (97)	0	-	253	3(1.2%)	Ax.L. 27.0mm or more	66 +/- 11.8	7 - 103	
Ku ⁹ (02)	62	1(1.6%)	63	1(1.6%)	Ax.L. 26.0mm or more	61.6 mean +/- 12.27	6 - 82	
Liang ¹⁰ (97)	0	-	90	1(1.1%)	Ax.L. 27.0mm or more	49 - 75	27 - 33	
Liesenhoff ¹¹ (94)	0	-	136	5(3.7%)	Ax.L. 26.0mm or more	33 - 92	Minimum 24	
Lyle ¹² (96)	109	1(0.9%)	0	-	IOL 11D or less & Ax.L. 26.0mm or more	39 - 89	3 - 79	
Nissen ¹³ (98)	0	-	237	4(1.7%)	Ax.L. 25.5mm or more	40 - 93	14 - 32	
Ravalico ¹⁴ * (03)	237	0	147	0	IOL 11D or less	21 - 90	8 - 146	
Ripandelli ¹⁵ (03)	930	74(8.0%)	0	-	-15D or more	39 - 81	36	
Tosi ¹⁶ (03)	73	1 (1.4%) †	0	-	Ax.L. 29.1mm or more	53 - 91	48 - 78	
Tsai ¹⁷ (07) ‡	36	?	16	?	Ax.L. 26.0mm or more	34 - 91	25 - 103	
Williams	72	2 (2.8%)	12	0	Ax.L. 26.0mm or more	32 - 92	93 - 147	
Zhang ¹⁸ (04)	68	0	0	-	Minus 10 D to minus 20D	27 - 85	3 - 12	
TOTAL / RANGE	2115	92 (4.4%)	1379	21 (1.5%)	-	21 - 93	2 - 147	

* Not including four cases of post-operative retinal tears were treated with laser retinopathy. † Not including three cases of post-operative retinal tear, treated with laser retinopathy. ‡ The figures on surgery and RRD numbers of Tsai *et al* were not included in the totals, as it was unclear how many undergoing each type of surgery had RRD. In this study two eyes developed RRD postoperatively

Ax.L - axial length, D - dioptres, N- number, Ref. - refraction, SE - spherical equivalent, Yr of pub - year of publication

hole were noted. Surgery consisted of pars plana vitrectomy, gas tamponade, laser and cryo retinopathy, and placement of a scleral sponge. Twelve months later the vision in this eye was 20/50, and he was discharged from clinic.

Fifteen other studies published after 1993 were found using Medline on the incidence of RRD after cataract extraction in high myopia (table II)⁶⁻²⁰. This figure does not include papers on lens extraction for primarily refractive purposes.

DISCUSSION

RRD is a well recognised complication of cataract surgery. Risk factors include refractive myopia and increased axial length⁵. The aim of the present study was to retrospectively examine our experience and to review selected factors influencing retinal detachment after cataract extraction in highly myopic eyes.

In our series 2.4% of high myopes developed RRD following cataract extraction, and the rate was one RRD per 441.6 person-years. No non-myopic control group was studied, but the incidence of RRD after cataract surgery in eyes of any axial length has been reported to be 0.5 to 1.0%³.

No data on the *rate* of RRD following cataract surgery in eyes of any axial length has been published to the best of our knowledge, although the risk at certain postoperative time points has been calculated⁶.

Many risk factors for RRD following cataract extraction have been identified. In summary⁵, reported risk factors include male sex, younger age, ethnic origin or race²¹, increased axial length, a history or family history of retinal detachment, lack of an intact posterior capsule, vitreous loss, vitreoretinal pathological features such as lattice degeneration or ocular trauma after surgery²². An intraocular lens implant is thought to be protective compared to aphakia¹⁰. The intraoperative maintenance of an intact posterior capsule is important in reducing the risk of RRD^{23,24}. Anterior vitrectomy is thought to be protective by preventing vitreoretinal traction. The two patients who developed RRD (table one) had risk factors for post-cataract surgery RRD as well as high myopia. Both were male. Case one had had Nd-YAG laser posterior capsulotomy. Case two had a history of phakic RRD in the fellow eye and during cataract surgery prolapse of a strand of vitreous occurred. In both cases of RRD in our series, there was a

history of head trauma temporally related to the apparent onset of an RRD. It would be impossible to accurately determine the prevalence of post-operative trauma in our sample. However we suggest that pseudophakic high myopes should be advised to avoid contact sports and if possible, situations where there is a risk of tripping or falling. It is noteworthy that in one of the two cases, the fellow-eye had no useful vision (table one): this reaffirms the importance of high quality cataract surgery in high myopes.

In this study both rate and incidence of primary or recurrent RRD are reported. The problem with the use of incidence is said to be the dependence on the length of follow-up²⁵. This is illustrated by the fact that in papers in which the incidence of RRD following phacoemulsification is less than our figure of 2.4%, the minimum follow-up is much lower than our minimum follow-up of over 7 years (93 months). In the pooled studies other than our own study, the median minimum follow-up time was 9 months (range 2 - 48 months), and the median maximum follow-up time was 80.5 months (range 12 - 147 months). Our follow-up time, of 93 to 147 months, is longer than most. Our follow-up data highlights that the risk exists for at least 5 years after surgery in high myopes, as one of the RRDs in our sample occurred 60 months after cataract surgery. It has been said that increased risk of RRD after cataract extraction remains up to two decades after surgery²³. However RRD occurring years after cataract surgery may be related to the natural history of myopia, rather than pseudophakia *per se*.

Rate is therefore said to be a more valid measure to report than incidence in case series in which the length of follow-up for each subject varies²⁵. As rate is not reported in any of the collated studies, incidence must be used to compare their results. The purpose of combining study estimates is that the resultant large number of subjects increases the likely accuracy of the estimate of incidence, at least for a minimum of two months follow-up (table II). One weakness of pooling estimates is that studies vary in several ways. Age-range and ethnicity of the sample, use of prophylactic laser, study design, surgical technique, length of follow-up and frequency of post-operative visits all vary. What is being estimated therefore becomes blurred. Conversely the action of pooling studies that vary in certain aspects may be to improve the generalisability of findings. Some studies used axial length to define myopia while others used a refractive criterion. Nevertheless, it is possible to combine the estimates of post-operative RRD incidence and define myopia simply as "high". In different studies intraocular lens implants were used in all, some or none of the subjects. Information on how many subjects received or did not receive a lens implant was not available in many of the papers. It is merely possible therefore to give a pooled estimate of RRD incidence following phacoemulsification with or without a lens implant, and for ECCE with or without a lens implant.

Jacobi *et al*¹⁰ summarised the results of eight other studies, published from 1984 to 1993, on pseudophakic RD in high axial myopia: in these studies the incidence of RD varied from 1.7% to 7.5%. We summarised findings of studies published from 1994 onwards, a period when the use of ECCE was declining and that of phacoemulsification increasing. When these studies are pooled, including ours, the mean incidence of

RRD following phacoemulsification, with or without an IOL, is 4.4% (range 0 to 8%), and following ECCE with or without an IOL the pooled mean is 1.5% (0 to 3.7%).

Both of our patients who developed retinal detachment had undergone phacoemulsification. In Northern Ireland almost all cataract operations are now done by phacoemulsification rather than by ECCE. In our study on surgery performed in the late 1990s, 84.5% of cataract operations were by phacoemulsification, the remainder being ECCEs. The collated results suggest that ECCE is associated with less risk of post-operative RRD than phacoemulsification. Future studies on surgery from more recent periods may show the reverse trend: a lower risk of RRD following phacoemulsification as ECCE is now often reserved for cataracts which are denser or more 'difficult' (for example, if there is zonular instability), and higher skill levels for phacoemulsification are established as the technique predominates. Furthermore phacoemulsification fluidics and small incisions are said to reduce forward movement of the vitreous¹⁸.

Posterior capsule opacification (PCO) requiring Nd-YAG laser occurred in 37.6% (n = 32) of eyes in our study. One would expect patients, individual clinicians and ophthalmology centres to vary in their tolerance of PCO and their readiness to intervene, and reported rates of laser for PCO vary widely²⁶. Nd-YAG laser capsulotomy is reported to increase the risk of RRD 3.9 fold²¹. The incidence of RRD following Nd-YAG posterior capsulotomy varies in the published data from 0²⁷ to 0.89%²⁸ to 10% in highly myopic eyes²⁹. One (3.1%) of the eyes in our study that underwent Nd-YAG laser developed RRD three months following capsulotomy. It is not clear how much the parameters of Nd-YAG laser influence the risk of RRD. For example it is unknown whether many small acoustic shock waves or few large waves passing through the posterior chamber have a greater effect: this may be worthy of further study. It is also not known how rupture of the posterior capsule, intra- or post- operatively, increases the risk of RRD although changes in the nature of the vitreous, rupture of the anterior hyaloid face and vitreoretinal traction caused by forward movement of the vitreous are important.

Some of the studies whose results were pooled used prophylactic laser for predisposing retinal lesions and some did not. In our study prophylactic laser was not performed in any case. Complete fundal examination with scleral depression was not performed in all our cases, and therefore it is impossible to comment on the prevalence of predisposing retinal lesions. In studies by Lyle and Jin¹⁴ and Fan⁹ on retinal complications following cataract extraction in myopia, none of the patients treated prophylactically with argon laser photocoagulation developed retinal detachment. However the benefit of prophylactic treatment of any type of retinal lesion is not established. Retinal tears and subsequent detachment can occur in previously normal areas of retina or at the edge of photocoagulation scars^{30,31}. Evidence for a policy of treatment only of symptomatic retinal tears was reported by Wilkinson³², and we feel our results support this policy.

Although our estimate of the incidence of RRD following cataract surgery in highly myopic eyes is similar to the incidence in the other pooled studies, our figures are subject to several potential sources of error. The two centres where

records were examined were the RGH and AAH, chosen as the only centres in the region in which RRDs were treated during the whole study period. The majority of RRDs in the region are treated at the RGH. However from 1997 RRDs were also treated at another unit (the Mater Hospital). Furthermore it is possible that RRD cases treated elsewhere were missed, or that some patients with RRD failed to seek care or were not referred to an ophthalmologist. We believe it is likely that few, if any, cases of RRD were missed. All of the patients had addresses in Northern Ireland at the end of the follow-up time, reflecting the stability of the population. The possibility remains however that our estimate of this complication is an underestimate. Also the number and timing of follow up visits varied among our patients. More frequent visits may in theory allow identification and treatment of tears before RD develops. The retrospective nature of our study implies reliance on case notes being accurate and complete, which is not certain. Nevertheless the present study serves to highlight RRD as a complication of cataract surgery, especially in high myopes.

Future case series should follow the advice of Jabs²⁵ to calculate rates to allow meaningful comparison of case series. A larger sample size than ours would provide more accurate data. Furthermore the precise prevalence of and risk posed by various predisposing retinal lesions, such as lattice and cobblestone degeneration, staphylomata and the state of the posterior vitreous, would be an interesting focus for prospective study. Our retrospective study relied on case notes, which did not uniformly record such details. Risk factors for pseudophakic RRD were present in both cases in our study that developed RRD. The risk of complications and the symptoms of RRD should be explained carefully to all patients pre-operatively, particularly myopes in whom RRD is more likely despite uncomplicated surgery or prophylactic retinal treatment. Should posterior capsular rupture occur during cataract surgery the ophthalmologist should be alert to the fact that how this is managed can influence the risk of subsequent RRD. Furthermore in high myopia the need for Nd-YAG posterior capsulotomy should be carefully weighed against the risk of RRD. Patient education is crucial given the variable but potentially long duration from surgery to RRD.

Acknowledgements: To Ms Y Suessmuth and Ms WW Liu for their help translating some referenced papers. The authors have no conflict of interest.

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