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Phenotype and outcomes of phakic versus pseudophakic primary rhegmatogenous retinal detachments: cataract or cataract surgery related?

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	Suggested Design section for the Abstract: Retrospective comparative clinical study
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Abstract

Purpose: To compare phakic and pseudophakic primary rhegmatogenous retinal detachments (RD) and, within phakic RD, eyes with and without cataract.

Design: Retrospective comparative clinical study

Methods

Setting: Online database of prospectively collected data.

Study population: Patients aged ≥ 50 years who had undergone RD repair.

Procedure: Data included baseline demographic and clinical features, surgical details, anatomical and functional outcomes. Univariate analysis was performed to compare pseudophakic with phakic RD, and phakic RD with and without cataract. Age and gender dependency of variables was analysed and the association of preoperative variables with final visual acuity was assessed using multivariate analysis.

Main Outcome Measures: Preoperative features, intraoperative management, postoperative outcomes, association of preoperative features with postoperative outcomes.

Results: Of 4231 eyes, 1332 were pseudophakic and 3019 phakic, amongst which 310 had cataract. Pseudophakic RD showed significant differences compared with phakic RD, including older age, higher prevalence of male gender, foveal detachment, grade C proliferative vitreoretinopathy (PVR), inferior retinal breaks, inferior retinal involvement and greater RD extent. Despite the more advanced features of pseudophakic RD, pseudophakia was a positive factor for visual outcome. Contralateral RD was more frequent in pseudophakic than phakic RD eyes ($p < 0.0001$). Within phakic RD, phakic RD with cataract exhibited several similarities with pseudophakic RD, including greater age, more frequent foveal detachment, PVR and greater RD extent.

Conclusions: The presenting features differed significantly between pseudophakic and phakic RD, with greater occurrence of inferior retinal breaks and inferior retinal involvement in particular. Phakic RD with cataract shared several features in common with pseudophakic RD.

Title: Phenotype and outcomes of phakic versus pseudophakic primary
rhegmatogenous retinal detachments: cataract or cataract surgery related?
Short title: Retinal detachment associated with pseudophakia and cataract

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Introduction

Rhegmatogenous retinal detachment (RD) has an annual incidence ranging from 0.01 to 0.02% in the general population.¹ Cataract surgery is a widely recognized risk factor for RD,²⁻⁴ particularly in case with intraoperative complications, such as posterior capsule rupture.^{5,6} Indeed, the incidence of pseudophakic RD has been reported as being 0.36 to 2.9% within the first 10 years after phacoemulsification, representing an approximate 4 times increased risk compared to the fellow non operated eye when age and gender matched.⁷ As cataract surgery is one of the most commonly performed surgical procedure, it is not surprising that pseudophakic RD represent a significant proportion of RD, accounting for some 22-37% of cases in developed countries, and likely to increase as the population ages, and the number of cataract operations increases.^{1,8,9}

A variety of hypotheses have been proposed for the association of RD with cataract surgery including vitreous traction during surgery, changes in vitreous composition with a higher incidence of posterior vitreous detachment following surgery, as well as shared genetic pre-dispositions.^{3,10,11} These mechanistic hypotheses might suggest that there would be differences in the clinical features between pseudophakic RD and phakic RD and there is some, albeit limited data, to suggest that this may be the case.¹²⁻¹⁴

Interestingly, there have also been differences described in the size of retinal breaks, presence of PVR and frequency of foveal involvement in phakic RD depending on the presence of cataract.¹³ An accurate characterization of pseudophakic RD compared to phakic RD, with and without visually significant cataract could provide insight into their pathogenesis, as well assisting in surgical approach, and analysis of outcomes.

The aim of this study was to analyze the differences in clinical characteristics between phakic RD with and without cataract, and pseudophakic RD in a large cohort of prospectively evaluated patients.

Methods

The data for this analysis were extracted from the Britain & Eire Association of Vitreoretinal Surgeons (BEAVRS) RD audit database in May 2018, including all RDs that had undergone surgery of any type (i.e. vitrectomy, buckling, pneumatic retinopexy or combinations thereof) from March 2011 to March 2018. The BEAVRS database is compliant with the UK national RD dataset (<https://www.rcophth.ac.uk/standards-publications-research/audit-and-data/clinical-data-sets/retinal-detachment-data-set/>).

The database only includes primary rhegmatogenous RDs, and excludes RDs secondary to severe contusion, penetrating injury, vaso-proliferative disorders, inflammatory eye disease, ocular dystrophies and pediatric RD. Data is entered at the end of surgery and then again at the end of the postoperative follow-up (FU) with a stipulation that this is at least 2 months following surgery. The data collected include demographic and preoperative clinical findings such as age, sex, comorbidity, lens status including the presence of cataract, intraocular pressure, visual acuity (VA), duration of central vision loss, ocular co-pathology potentially interfering with the functional outcomes, presence and grade of vitreous hemorrhage (VH) (scored from 0, in absence of VH, to 4, in presence of VH completely obscuring the fundus),¹⁵ anatomical findings of RD, and a history of a fellow eye RD. Intraoperative and surgical details such as gauge of vitrectomy system, type of tamponade, type of scleral buckle

(SB) if performed, modality of retinopexy, combination of cataract surgery, and any complications and postoperative outcomes including length of follow up, anatomical success and visual acuity were recorded. With regard to the RDs, the anatomical findings recorded are the extent of RD (in clock hours), number, type and location of retinal breaks, extent of the biggest retinal break (in clock hours), location of the lowest retinal break, foveal involvement, and the presence, extent and grade of proliferative vitreoretinopathy (PVR), according to the revised Silicone Oil Study grading system.¹⁶ Moreover, to facilitate the collection of data, a RD drawing tool is linked to the diagnostic grading of the above mentioned details (Figure 1).

Primary anatomical success in the dataset is considered as complete retinal reattachment in the absence of tamponade and without any additional re-attachment procedures.

Only patients aged more than 50 years were included in the analysis. The eyes were divided in two groups on the basis of lens status, namely phakic RD and pseudophakic RD. Moreover, a subgroup analysis of phakic RD was carried out dividing between phakic RD with cataract and phakic RD without cataract.

To analyse for differences in the distribution of the RD we derived a number of groups based on their location including those localized to one quadrant or hemisphere only, as well as those with any involvement of the superior or inferior retina.

This study followed the UK's Data Protection Act and the declaration of Helsinki. The database does not contain any data from which the identity of a patient might be established. Internal identification is via a unique random alphanumeric code. No IRB approval and/or informed consent were therefore needed according the UK guidelines; the database being considered instead a service evaluation.

Statistical analysis

Descriptive and statistical analysis was performed using SPSS version 24. Patient demographics, pre-operative features, surgical management and post-operative outcomes were initially compared between phakic RD and pseudophakic RD. A subgroup analysis for the same variables was then performed between phakic RD with cataract and phakic RD without cataract.

All VA values were converted to logMAR values for analysis, considering count fingers (CF), hand movements (HM), perception of light (PL) and no perception of light (NPL) equivalent to 1.98, 2.28, 2.70 and 3.00 respectively.¹⁷

Two-sample independent t-tests were used to compare continuous variables.

Associations between non-continuous variables were analysed using the chi-square test and Fisher's exact probability. The effect of gender and age on the variables and outcomes evaluated, was investigated using linear and logistic regression. Binomial regression was used to assess the variables influencing the final visual acuity.

Statistical significance was considered if p-value < 0.005, based on the exploratory nature of the analysis and the number of comparisons made.

Results

The data of 5181 eyes treated for RD were extracted. We excluded data on 950 eyes as the patients were younger than 50 years. Of the remaining 4231 eyes, 3019 were phakic and 1332 pseudophakic. Moreover, among the phakic RD, 310 eyes were

identified as being phakic with cataract and 2709 phakic without cataract.

Univariate analysis

Pseudophakic RD versus phakic RD

The results of the univariate analysis to compare phakic RD with pseudophakic RD, and phakic RD with and without cataract are presented in Tables 1-3.

Pseudophakic RD affected an older age group. There was a higher prevalence of right eye involvement in both groups, with no significant difference between the groups. A male predominance was observed in both groups, and was significantly more marked in the pseudophakic RD group.

Pseudophakic RD had worse VA at presentation. Other features significantly more common in pseudophakic RD were presence of posterior vitreous detachment (PVD), foveal detachment, inferior retinal breaks and PVR grade C, whereas vitreous hemorrhage (VH) was more frequently observed in phakic RD.

Pseudophakic RD were of greater extent and had more common involvement of the inferior retinal quadrants (RQs), with phakic RD being more commonly localized to the superior and temporal zones.

With regard to the surgical management, pars plana vitrectomy (PPV) was by far the most commonly performed procedure in both groups. There was no significant difference in anatomical success, but the pseudophakic RD group has significantly improved visual outcomes.

A history of a fellow eye RD was significantly more common in pseudophakic RD than phakic RD.

Phakic RD with cataract versus phakic RD without cataract (See tables 1-3)

Patients with phakic RD with cataract were older and had worse initial VA than patients with phakic RD without cataract.

Phakic RD with cataract were characterized by a significantly higher rate of PVD, foveal detachment, RD extent and presence of PVR grade C.

There were significantly more superior RDs in the phakic RD without cataract group and a greater involvement of the inferior retina in the phakic RD with cataract similar to the pseudophakic RD group.

No significant difference was found in the choice of surgical procedure with a clear predominance of PPV in both groups again.

Both anatomical and functional outcomes were significantly worse in phakic RD with cataract. There were 154 patients who had combined phacovitrectomy performed in the phakic RD group, mainly in the phakic RD with cataract group. There were borderline significantly worse results both anatomically and visually in the phacovitrectomy group. ($p=0.03$ and 0.04 respectively)

Multivariate analysis for effects of age and gender (see Table 4)

Multivariate analysis demonstrated age dependency of several variables in both the pseudophakic RD and phakic RD. In both groups, increasing age correlated with a worse presenting and final VA, higher likelihood of foveal involvement, presence of PVR C, and greater RD extent.

The only effect of gender was on the age in the pseudophakic RD group where female patients were older than male patients. (median age male 67 versus 70 years for females. $P<0.001$)

Multivariate analysis for visual acuity ≤ 0.30 LogMAR at last follow-up (see Table 5)

Binomial regression showed that the likelihood of achieving final VA 0.30 logMAR or better was increased by several preoperative features, namely male gender, younger age, better initial VA, shorter duration of vision loss, smaller RD extent, inferior RD distribution only, absence of foveal detachment, PVR and importantly pseudophakia.

Discussion

In this large prospectively collected database study we have characterized the differences between the features and outcomes of phakic and pseudophakic RD, and have also assessed differences between phakic RD with and without cataract. Few previous studies have highlighted the specific features of pseudophakic DR compared to phakic eyes,^{3,13,14,18,19} whilst only one, as far as we are aware, has assessed phakic RD with and without cataract.¹³ These two research questions are related as there has been debate as to how much cataract surgery on its own contributes to RD, as compared to a genetic predisposition to both conditions. If the latter was correct then it might be expected that pseudophakic RD would share similarities with phakic RD with cataract, as compared to phakic RD without cataract. We studied an older than 50-year old age population to match the groups in terms of relationship with the onset of PVD, rather than confounding the results with atrophic break or dialysis related RD, typical of a younger age groups with a different RD phenotype. We confirmed some distinctive characteristics of pseudophakic RD as compared to phakic RD but, interestingly, also found that phakic RD with cataract, in contrast to phakic RD without cataract, showed some similarities with pseudophakic RD.

Epidemiological findings and genetic hypothesis

The overall male predominance of RD and mean age affected, is consistent with previous studies.^{8,12-14,20,21} However pseudophakic RD were older and more frequently male than phakic RD, whilst the phakic RD groups differed in age only. The age difference is likely explained by the lag time between cataract surgery and RRD where the risk is reportedly cumulative up to 10 years of follow up.¹

The gender difference is more complex to explain. Although the number of women undergoing cataract surgery in the general population is greater than men, the mean age of men is younger.^{6,7,22} Bjerrum et al. reported that the proportion of men aged 40-49 and 50-59 years undergoing cataract surgery was 2.9% and 8.9%, respectively, compared to female percentages of 1.6% and 5.8% in the same age ranges.⁷ It is also known that the RD risk after cataract surgery in men is not influenced by age whilst reduces with age in women, meaning that younger men in particular will end up with a greater proportion of pseudophakic RD.^{23,24} The higher prevalence of bilateral RD in the pseudophakic RD group also favors a male predominance, suggesting that genetic factors might have a role in pseudophakic RD. The extent to which phacoemulsification itself and/or a predisposition to cataract play a role in the pathophysiology of RD is still

matter of debate. A recent meta-analysis of genome-wide association studies demonstrated that the genetic correlation of RD with cataract requiring surgery was 0.44.²⁵ The proportion of RD liability contributed by common genetic variants has been estimated at between 23 to 27%, and between 35-48% for age-related cataract.²⁶ It is known that the phenotypic correlation of RD with cataract surgery will be limited by the degree of genetic correlation and also by the heritability of each trait.²⁷ With approximately 20-33% of RD cases being pseudophakic this would suggest that ~ 50% of the risk for pseudophakic RD was genetic, which fits in with our findings on bilateral RD. This is also supported by the fact that population studies on patients undergoing sequential cataract surgery, have suggested that patients with cataract have a substantially higher risk of RD prior to cataract surgery.⁷

Anatomical features: pseudophakic RD versus phakic RD

The clinical findings, in particular foveal involvement and distribution of retinal breaks and subretinal fluid, are crucial to plan the timing and type of surgical management. In this regard, we found that in pseudophakic RD:

- the fovea is more commonly involved, as previously reported¹³;
- the RD is more extensive with a higher prevalence of inferior half involvement and inferior breaks;
- the rate of PVR grade C is higher, in agreement with a previous study¹³.

Pseudophakic RD was less frequently confined to individual quadrants or halves of the retina; indeed, over 50% of cases involved 3 or more quadrants of the retina, compared to less than 40% in the phakic RD group. Phakic RD were more frequently confined to the superotemporal and superior zones, whilst pseudophakic RD more frequently involved the inferior half of the retina. Moreover, in terms of location of retinal breaks we found that the difference was driven by breaks located in the lowest two clock hours of the retina ie between 5 and 7 o'clock. Although pseudophakic RD have classically been described with multiple small anterior retinal tears, we did not find any significant difference in the number of retinal breaks comparing pseudophakic and phakic RD.^{1,13,18} The higher rate of PVR grade C could possibly be associated with the greater extent and longer duration of the pseudophakic RD cases,²⁸ but may represent an intrinsic difference between the two groups. We did not have data on the timing of prior cataract surgery or the occurrence of complications which is a limitation of our study, but previous studies found no difference in the level of cytokines previously associated with PVR between pseudophakic RD and phakic RD eyes.^{29,30}

Anatomical features: phakic RD with cataract versus phakic RD without cataract

This is the largest study to date that has studied phakic eyes with and without cataract. Consistent with the only previous study to have looked at this, we found several similarities with pseudophakic RD, including a higher proportion of foveal detachment and PVR, in phakic RD with cataract compared with phakic RD without cataract.¹³ This couldn't be explained by duration of RD with no significant difference between the groups, but we cannot exclude later presentation in the cataract group completely. Patients with phakic RD with cataract were significantly older than those without cataract, having a median age similar to that of pseudophakic group. However, we were

also able to identify other differences; phakic RD with cataract cases showed a significantly greater extent and more frequent involvement of the inferior retina than phakic RD without cataract. Moreover, in contrast to that reported by Mahroo et al., phakic RD with cataract showed a trend to a greater number of retinal breaks ($p=0.006$).¹³

Surgical management and outcomes

The vast majority of cases in this study were treated with vitrectomy alone, consistent with recent trends in surgical choice in the UK.³¹ Despite the higher rate of inferior breaks in the pseudophakic RD group, there were very few combined vitrectomy and scleral buckling surgeries. Whether combined vitrectomy and scleral buckle surgery offers any advantage compared with vitrectomy alone is still unclear. A large retrospective study published this year demonstrated a higher single surgery success rate with combined surgery.³² Conversely, a large multicenter randomised trial reported no additional benefit of combined surgery in either pseudophakic or phakic RD including those with inferior retinal breaks.^{33,34}

The anatomical success rate in pseudophakic RD cases was 85%, similar compared with phakic RD (88%), despite many of the clinical findings of the pseudophakic RD group having been previously identified as risk factors for primary anatomical failure.^{31,35,36} It is possible that an improved fundal view and peripheral retinal access intraoperatively in pseudophakia, with more complete identification of retinal breaks, peripheral vitrectomy and drainage, etc., led to better outcomes and mitigated the effects of the adverse prognostic features. Moreover, pseudophakic RD had significantly better visual outcomes, in terms of both overall final VA and proportion of eyes with final VA 0.3 logMAR or better. It is likely that lens opacities in the phakic group confounded the visual findings, but it confirms that in routine clinical practice vitrectomy alone is a successful treatment for both groups of patients.

Both anatomical and functional outcomes were worse in phakic RD with cataract compared with phakic RD without cataract group. The greater severity of initial clinical findings and the presence of cataract limiting the view during surgery may explain these results.^{36,37} Moreover, the predictable progression of cataract after vitrectomy may have also contributed to the worse vision. Although the combination of phacoemulsification with vitrectomy (phacovitrectomy) has been described as a safe and effective surgical option,^{38,39} many surgeons in the UK prefer sequential cataract surgery for RRD.⁴⁰ This could be attributed to concerns related to combined surgery, including the less certain refractive outcome and the formation of posterior synechiae in up to 30% of cases.³⁸ Interestingly, the cases that did have combined phacovitrectomy had worse outcomes both anatomically and visually than the vitrectomy alone cases although this could have been confounded by case mix.

The effect of age

Related to the finding that the pseudophakic RD group contained older, and more male patients we investigated the effect of age and gender on the variables studied in the pseudophakic RD and phakic RD groups. Mahroo et al have previously reported a relationship between age and the presence of inferior retinal breaks and foveal detachment.¹³ We confirmed the increasing prevalence of foveal involvement with age

but not the effect of age on retinal breaks location. The association of inferior retinal breaks would seem therefore to be specific to pseudophakic RD. Furthermore, the trend of pseudophakic RD and phakic RD with cataract to having a greater number of retinal breaks did not appear to be influenced by age. RD distribution showed age-dependency in both the pseudophakic RD and phakic RD groups, with increasing age associated with a reducing prevalence of superior quadrant involvement, but with an increasing involvement of the inferior quadrants suggesting that at least some of the differences in distribution in pseudophakic RD are related to the older age group affected.

Increasing age was associated with lower postoperative visual acuity in both groups and a lower anatomical success rate in the phakic RD group, but not in the pseudophakic RD group. It is possible that in older phakic eyes, the increased size of the lens can limit the ability to perform certain surgical maneuvers during PPV, such as internal searching and peripheral shaving, which is not the case with pseudophakic RD. Pseudophakia remained a significant factor positively affecting postoperative VA with multivariate analysis.

Limitations and conclusions

We acknowledge that this study has several limitations. The study based on its database design relied on prospective case recording and contemporaneous outcomes assessment however we found no evidence of systematic differences in data recording between the groups studied. We accept however that the mechanism for completion of the database as an add on to standard patient records, can have some intrinsic limitations, as reflected by the high percentage of “uncertain or missing” vitreous status and the percentage of missing outcome data that, even if similar between the groups, potentially could hide some important information. There was no patient identifier to allow the use of patients rather than eyes as a cluster variable in the analysis however, we believe that this would have affected only a relatively small number of patients. The BEAVRS database is completed by a self-selected group of surgeons, and thus may be not representative of overall UK vitreoretinal surgical practice. We used the presence of cataract as criterion to distinguish phakic RD with and without cataract, but the criteria used in reporting ‘cataract’ was not standardized, and likely included a range of severities and types. The RD drawing tool used to record data only recorded break size in whole clock hours and does not record location with respect to equator and hence we couldn’t analyze for break size below one clock hour in extent or the antero-posterior location of retinal breaks.

Conclusion

Our study has shown that there are significant differences between pseudophakic RD and phakic RD in terms of presenting clinical findings and RD distribution. The presence of retinal breaks in the lower two clock hours in particular appears to be specific to pseudophakia. Interestingly, phakic RD with cataract share several clinical features with pseudophakic RD. The greater age of pseudophakic RD and phakic RD with cataract could contribute to the these finding, but further study of the potential role of shared genetic factors, supported by the increased rate of bilaterality in pseudophakic RD would be of interest. Despite having a more advanced presentation, and several

features previously associated with worse anatomical and functional outcomes, the success rate of pseudophakic RD repair is high and visual outcomes generally good.

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Figure Captions

Figure 1. Drawing tool of BEAVRS database. Example drawing of a foveal involving retinal detachment with three retinal tears and proliferative vitreoretinopathy grade C represented by an inferotemporal star fold. As each icon is linked to a diagnostic code, the values are directly uploaded in the side boxes for the collection of data.

Table 1. Demographic and clinical findings at presentation in pseudophakic and phakic eyes with retinal detachment. Phakic group further divided in phakic eyes with and without cataract at baseline.

	Pseudophakic RD n=1212	Phakic RD n=3019	p-value	Phakic RD with cataract n=310	Phakic RD without cataract n=2709	p-value
Age, years; median, (IQR)	68, (61-75)	62, (56-69)	<0.001	69, (62-75)	62, (56-68)	<0.001
Gender; % male	68%	60%	<0.001	59%	61%	0.686
Study Eye; % right	55%	54%	0.52	58%	54%	0.132
Presenting VA, logMAR; median, (IQR)	1.00, (0.18-2.28)	0.78, (0.18-1.98)	0.001	1.98, (0.38-2.28)	0.78, (0.18-1.98)	<0.001
Duration of visual loss, days; median, (IQR)	6, (3-15)	5, (3-11)	0.017	6, (3-15)	5, (2-11)	0.095
IOP, mmHg; median, (IQR)	15, (12-16)	15, (12-16)	0.584	13, (11-16)	15, (12-16)	0.005
Bilateral RD; % present	8.92%	5.81%	<0.001	6.57%	5.33%	0.149

IQR - interquartile range; VA - visual acuity; logMAR - logarithm of the minimum angle of resolution; IOP - intraocular pressure; RD - retinal detachment.

Table 2. Anatomical features of retinal detachment in pseudophakic and phakic eyes at baseline.

	Pseudophakic RD n=1212	Phakic RD n=3019	p-value	Phakic RD with cataract n=310	Phakic RD without cataract n=2709	p-value
Vitreous status; %			<0.001			<0.001
- No PVD	1%	2%		2%	2%	
- PVD	75%	73%		87%	72%	
- Uncertain or Missing data	24%	25%		11%	26%	
Vitreous hemorrhage; % ¹⁵			0.005			0.041
- Grade 0	85%	80%		75%	81%	
- Grade 1 and above	15%	20%		25%	19%	
Fovea on; %	39%	47%	<0.001	36%	48%	<0.001
RD extent; median, (IQR)						
- clock hours	6, (4-8)	4, (4-7)	<0.001	5, (4-7)	4, (3-6)	<0.001
RD extent- quadrants; %			<0.001			<0.001
- 1	8%	16%		11%	16%	
- 2	40%	47%		42%	48%	
- 3 or more	52%	37%		47%	36%	
Total RBs; median, (IQR)	2, (1-4)	2, (1-4)	0.590	2, (1-4)	2, (1-3)	0.006
Largest RB type; %			0.038			0.586
- giant	2%	2%		1%	2%	
- round hole	6%	9%		10%	9%	
- U tear	89%	87%		86%	88%	
- RB not found	3%	2%		3%	2%	
Inferior retinal breaks; %	31%	23%	<0.001	23%	23%	0.979
- within 2 clock hours of horizontal midline (3 to 5 and 7 to 9 O'clock)	10%	10%	0.920	11%	10%	0.691
- lower 2 clock hours (5 to 7 o'clock)	21%	13%	<0.001	12%	13%	0.701

RQ - solo involvement; %						
- only superotemporal	4%	9%	<0.001	7%	10%	0.141
- only superonasal	3%	4%	0.164	2%	4%	0.118
- only inferotemporal	1%	2%	0.007	2%	2%	0.948
- only inferonasal	1%	1%	0.810	0%	1%	0.159
- only superior	20%	31%	<0.001	22%	32%	0.001
- only inferior	7%	7%	0.776	4%	7%	0.025
- only temporal	21%	33%	<0.001	34%	33%	0.950
- only nasal	8%	7%	0.720	4%	8%	0.024
RQ - any involvement; %						
- including superior retina	92%	93%	0.191	95%	93%	0.115
- including inferior retina	79%	69%	<0.001	77%	68%	0.002
PVR grade C; %	10%	7%	0.005	15%	7%	<0.001
Subretinal bands; %	4%	2%	0.003	4%	2%	0.082
Choroidal effusion; %	1%	1%	0.264	2%	1%	0.067

PVD - posterior vitreous detachment; RD - retinal detachment; IQR - interquartile range; RB - retinal break; RQ - retinal quadrant; PVR - proliferative vitreoretinopathy.

Table 3. Surgical management and outcomes in pseudophakic and phakic eyes with retinal detachment. Phakic group further divided in phakic eyes with and without cataract at baseline.

	Pseudophakic RD n=1212	Phakic RD n=3019	p-value	Phakic RD with cataract n=310	Phakic RD without cataract n=2709	p-value
Surgery performed; n	1209	3003		308	2695	
- vitrectomy; %	98%	96%	0.001	98%	96%	0.156
- scleral buckle; %	0%	3%	<0.001	2%	3%	0.178
- vitrectomy + buckle; %	2%	1%	0.010	0%	1%	0.507
- pneumatic retinopexy; %	<0.5%	<0.5%	0.530	<0.5%	<0.5%	1.000
Phacoemulsification combined with vitrectomy; %	N/A	3.8%	N/A	20%	2%	<0.001
Tamponade in cases undergoing vitrectomy; n	1202	2897		301	2596	0.015
- Gas; %	91%	93%	0.004	90%	93%	0.015
- Silicone oil; %	9%	7%	0.004	10%	7%	
Missing outcome; %	14%	12%	0.229	16%	12%	0.044
Follow-up duration, days; median, (IQR)	82, (61-117)	83, (61-125)	0.307	76, (57-145)	84, (62-123)	0.308
VA at last follow-up, logMAR; median, (IQR)	0.18, (0.00-0.48)	0.30, (0.18-0.60)	0.001	0.48, (0.18- 0.78)	0.30, (0.18-0.60)	<0.001
Final VA $\leq$ 0.3 logMAR; %	67%	59%	<0.001	49%	60%	0.002
Primary anatomical success in those with known outcomes; %	85%	88%	0.026	82%	89%	0.002

IQR - interquartile range; VA - visual acuity; logMAR - logarithm of the minimum angle of resolution.

Table 4. Age dependency in pseudophakic and phakic eyes with retinal detachment. (only showing variables with a significant association with age)

Variable/ Age in years	[50,59]		[60, 69]		[70, 79]		≥80		p-value	
	Pseudo-phakic RD (n=256)	Phakic RD (n=1134)	Pseudo-phakic RD (n=444)	Phakic RD (n=1172)	Pseudo-phakic RD (n=341)	Phakic RD (n=579)	Pseudo-phakic RD (n=171)	Phakic RD (n=134)	Pseudo-phakic RD	Phakic RD
Presenting VA, logMAR; median	0.48	0.48	0.78	0.78	1.64	1.98	2.28	1.98	<0.001	<0.001
Fovea On; %	53	55	43	45	35	39	20	31	<0.001	<0.001
Total extent – clock hours; median	5	4	5	4	6	5	7	6	<0.001	<0.001
Quadrants; mean	2.7	2.3	2.7	2.4	2.8	2.6	3.1	2.9	0.003	<0.001
RQ – superior only; %	23	36	24	33	19	21	11	13	<0.001	<0.001
RQ – including inferior retina, %	76	64	76	67	80	79	88	86	<0.001	<0.001
PVR grade C; %	7	4	7	7	12	13	18	19	<0.001	<0.001
Primary anatomical success in those with known outcomes; %	88	91	84	89	87	86	81	76	0.112	<0.001
Final VA ≤ 0.3 logMAR; %	75	67	71	60	64	47	46	28	<0.001	<0.001
VA at last F/U, logMAR; median	0.18	0.18	0.18	0.30	0.30	0.48	0.48	0.60	<0.001	<0.001

VA - visual acuity; logMAR - logarithm of the minimum angle of resolution; RD - retinal detachment; RQ - retinal quadrant; IN - inferonasal; IT - inferotemporal; PVR - proliferative vitreoretinopathy; F/U - follow-up.

Table 5. Multivariate analysis of effect of baseline features of retinal detachment on final postoperative visual acuity.

Baseline Variable	Final VA ≤ 0.3 logMAR n=1908	Final VA > 0.3 logMAR n=1222	p-value
Gender; % male	63%	61%	0.001
Age, years; median (mean)	63 (63)	66 (66)	<0.001
Lens Status; % phakic	69%	75%	<0.001
Foveal Attachment; % on	60%	21%	<0.001
Tamponade used in vitrectomy; % Gas	98%	86%	<0.001
RD Distribution			<0.001
- Superior only %	35%	16%	
- Inferior any %	65%	84%	
PVR grade C; % present	4%	14%	0.003
Presenting VA, logMAR; median (mean)	0.30 (0.80)	1.98 (1.60)	<0.001
Total extent – clock hours; median (mean)	4 (5)	6 (7)	<0.001
Duration of RD, days; median (mean)	4 (8)	7 (23)	0.004

VA - visual acuity; logMAR - logarithm of the minimum angle of resolution; RD - retinal detachment; PVR - proliferative vitreoretinopathy.

Operative Findings

* Foveal Attachment

Off

V

* Extent ST Quadrant

3

V

clock hours

* Extent SN Quadrant

0

V

clock hours

* Extent IN Quadrant

2

V

clock hours

* Extent IT Quadrant

3

V

clock hours

* PVR CP

1

V

clock hours

* PVR CA

0

V

clock hours

Breaks in Detached Retina

3

V

Breaks in Attached Retina

0

V

* Largest Break Type

U tear

V

* Largest Break Size

0

V

clock hours

Lowest Break Position

0

V

clock hours

* PVR Type

C

V

Subretinal Bands

O

Yes

☒

No

Choroidals

O

Yes

☒

No

Notes

This study compared the epidemiological and clinical features, surgical management and outcomes of over 4000 pseudophakic versus phakic retinal detachments, as well as within the phakic eyes, cases with and without cataract. Pseudophakic and phakic retinal detachments differed significantly in terms of their age, gender, fellow eye history and clinical features. By distinction, pseudophakic retinal detachment and retinal detachment with cataract shared several clinical similarities.

Highlights

- Pseudophakic (PsRD) and phakic retinal detachments (PhRD) differed significantly in terms of preoperative characteristics,
- Pseudophakic RD and PhRD with cataract showed several clinical similarities.
- These results may support the role of an inherent genetic predisposition to PsRD, in addition to cataract surgery itself.