Characteristics of retinal detachment associated with atopic dermatitis

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Abstract

Purpose: To examine the characteristics of rhegmatous retinal detachment(RRD) associated with atopic dermatitis.

Study design: retrospective case-control study

Method

The study was conducted between 2008 and 2018, whereby 2257 patients underwent RD surgery at this clinic. Among them, 61 patients who have been diagnosed as atopy were treated as experimental group, and 100 patients who didn't have atopy were randomly selected as control group.

MAIN OUTCOME MEASURES: In this study, demographics, characteristics of detachment, initial operative method, and prognosis after surgery were investigated. Additionally, in pseudophakic RD patients, the period between the cataract surgery and onset of RD was measured.

Result: In atopy group, postoperative VA and prognosis were significantly worse and bilateral involvement of RD was more common than control group. However, it is notable that there was no difference of mean preoperative VA and refractive index between two groups. There was a difference in characteristics of retinal breaks in two groups. Additionally, it was noted that in pseudophakic patients, the risk of developing RD within 1 year after cataract surgery was significantly higher in atopic group than in control group.

Conclusion: Generally speaking, RD in atopy occurs at a young age and has different characteristics noted than with non-atopic patients. In this context, atopic RD has poor visual prognosis, and for this reason it requires careful management. Furthermore, the risk of developing RD within 1 year after cataract surgery is higher in atopy, and thus we suggest regular and extensive check-up after cataract surgery especially in atopic patients.

Introduction

To begin with, atopic dermatitis is a common disease with a worldwide prevalence of 15-25% in children and 1-3% in adults, and it has been reported to have a similar prevalence in Korea.[1]

According to previous study, atopic patients have 2 to 12 times more ocular disease such as dry eye, keratoconjunctivitis, keratoconus, retinal detachment, glaucoma, and cataract compared with the incidence in a non-atopic population. In particular, retinal detachment occurs 3.22 times more than in the general population.[2]

Generally speaking, RD is a complication that can cause severe visual loss and it occurs at a frequency of 8-10% in patients with atopic dermatitis between the ages of 10 and 30.[3-5] It is known to develop at a younger age and have poor prognosis as compared with a population without atopic dermatitis.[6, 7]

The causes of atopy-related RD have not been elucidated yet, but there are many theories; RD might be caused by atopic edema induced by allergies or blood vessel abnormalities which are associated with atopic dermatitis,[8] and diseased vitreous can cause retinal break due to immune response,[9] or the most widely accepted theory is that the frequent rubbing of the eye in patients with atopy might lead to traction and retinal tear of the anterior vitreous, resulting in RD. There is also a study that the incidence of RD is about 8 times higher in people with frequent eye rubbing.[10]

It is noted that RD associated with atopy is more frequent in bilateral involvement than associated with congenital, inflammatory, or high myopia, and also related with a higher risk of surgical failure due to PVR.[11]

Although the risk of RD in atopy patients is known to be high, there have been few studies on the clinical characteristics of atopy RD and association with cataract surgery is unknown. Therefore, we are going to investigate the frequency and clinical characteristics of atopic RD in patients who have been followed up for a relatively long time in a single institution

The purpose of our study was to identify the characteristics of RD associated with atopic dermatitis during 10 years, and to compare with non-atopic RD.

Methods

The study was conducted between 2008 and 2018, whereby 2257 patients underwent RD surgery in Seoul St. Mary's Hospital, Seoul, Republic of Korea. The medical records of all patients were retrospectively reviewed. Notably, 61 patients with atopy were treated as the experimental group and 100 patients without atopy were treated as the control group. Patients with atopy were previously diagnosed as atopy by a dermatologist. Of the 2197 patients except the atopy RD group, who didn't have atopy, 100 patients were randomly selected as representative of the control group. Of the total RD patients, 2.7% had atopic dermatitis. Finally, patients with RD due to trauma, exudate, and macular hole was excluded from the study.

Ethical approval and consent to participate

This study was performed according to the tenets of the Declaration of Helsinki, and the study protocol was approved by the institutional review/ethics boards of the Catholic University of Korea and our hospital. Informed consent was waived owing to the retrospective nature of this study, and patient records were anonymized prior to all records analysis. All protocols were approved by the Institutional Review and Ethics Boards of Seoul St. Mary's Hospital, South Korea.

All patients in the study underwent a complete preoperative evaluation, which included a comprehensive history taking, best-corrected visual acuity (BCVA) measurement, slit-lamp microbioscopy, fundus examination with a contact wide angle viewing lens (Superquad 160, Volk) that can evaluate range, type and location of retinal break, optical coherence tomography to confirm macular involvement, presence of

proliferative vitreoretinopathy (PVR) (those classified as Grade 3 or above according to the classic classification of the Retina Society)[12].

We classified break type into 6 categories; retinal dialysis, horseshoe tear, retinal tear (as tear except horseshoe tear), hole with lattice, hole without lattice, and if the type of break is unclear, it was classified as an unknown type. Additionally, we also classified the location of the break into 5 categories; superotemporal, inferotemporal, superonasal, inferonasal, or unknown.

=Generally speaking, the BCVA and refraction were compared before surgery, and refraction was excluded if they were in a pseudophakic state. In eyes with a history of cataract surgery, the mean period between the cataract surgery and diagnosis of RD was recorded.

The range of the area in which RD involved was counted by the number of quadrants.

In all patients, the surgeon decided the surgical procedure by considering fundus and lens status, age, location of tear, PVR. Here, the surgery was performed either by the procedure of silicone sponge buckling or encircling, 23 or 25 gauge pars plana vitrectomy, or both. Likewise, if it was necessary, additional sub-retinal drainage, air-gas exchange, silicone oil implantation, and laser photocoagulation were performed if required in this case.

To evaluate an anatomical and functional outcome, the postoperative BCVA and recurrence rate were investigated at 6 months and last FU after surgery.

In subjects with RD both eyes, each eye was recorded separately. But in two cases of the atopy group, the opposite eye was a localized RD and cured only with the use of a barrier laser, and for that reason those two subjects were excluded. Among the evaluated bilateral patients, if the operation of the other eye performed in other hospital, the other eye was excluded in the study; one case in each group.

Statistical analysis

To begin with, for the VA analysis, we converted the logarithm to the minimum Angle of Resolution (log MAR) VA for statistical analysis. The VA of counting fingers, hand movements, light perception were then assigned ratios of 0.01, 0.001, 0.0005, respectively. In addition, a Chi-square test, Mann-Whitney test, and paired t-test were used as statistical testing tools in this study. Therefore, all statistical analyses were performed using SPSS statistical software for Windows, version 25.0 (SPSS, Chicago, IL) The statistical significance level was set at $P < 0.05$.

Results

In this study, there were a total of 2257 patients who had RD surgery in our clinic between 2008 and 2018. Of these, 61 patients had atopic dermatitis and it accounts for 2.7% of total RRD patients.

It is noted that the demographics of the study participants were presented in Table 1.

Table 1. Demographic and clinical characteristics of the study participants.

	Atopy	Non-atopy	P value
Demographics			
No. of patients (eyes)	61 (71)	100 (100)	
Sex - male:female (%)	39:22 (64:36)	63:37	0.811
Mean age (year)	23.08±10.24	52.29±15.48	0.000*
Involved eye - OD:OS (%)	37:34 (52:48)	50:50	0.785
Preop VA (Log MAR)	1.14	0.96	0.294
Number of bilateral involved patients: n (%)	13 (21%)	1 (1%)	0.000*
Lens status; phakic: pseudophakic (%)	43:28 (60:40)	74:26	0.063

Values are presented as mean ± SD unless otherwise indicated.

VA = visual acuity.

*p-value by Mann-Whitney U test and chi-square test

Of the total 61 patients with atopy, 13 patients had bilateral RD. Two of them were seen to have localized RD and treated only with barrier laser, and for that reason they were not included in the study. Additionally, 1 patient received RRD surgery from another hospital, and for that reason the opposite eye was excluded from the experimental group. Therefore, it is noted that a total of 71 eyes were included in the atopy group.

As was seen, of the 100 control patients, only one patient had bilateral RD. However, the other eye was received RD surgery from another hospital, and therefore not included in the study. In this respect, a total of 100 eyes were included in the control group.

Thus, the rate of bilateral RD was 21% in the atopic group and 1% in the control group. Notably speaking, the rate of bilateral involvement was significantly higher in the atopic group (P value 0.000).

In this study, there were 39 males (64%) and 22 females (36%) in the atopy group, and 63 males (63%) and 37 females (37%) in non-atopy group (P value 0.811).

In this respect, the average age was 23.08±10.24 years in the atopy group, and 52.29±15.48 years in non-atopy group (P value 0.000). Additionally, the mean age was statistically significantly younger in atopy group (Table 1, Figure 1).

In the atopy group, 37 had RD in the right eye and 34 had RD in the left eye. In the non-atopy group, 50 had RD in right eye and 50 in left eye. Likewise, in both groups, a similar rate occurred in both eyes. There

was also no statistically significant difference in the lens status (phakic or pseudophakic) between the two groups.

In this case, the mean spherical equivalent before surgery was -3.09 ± 0.392 in the atopic group and -3.56 ± 0.372 in the control group, there was no statistical difference (P value 0.953, Table 2).

Table 2. Refractive status before surgery.

Refractive status	Atopy	Non-atopy	P value
Spherical equivalent	-3.09 ± 0.392	-3.56 ± 0.372	0.953
(Mean $\pm$ SD)			
hyperopia	1 (1%)	7 (7%)	
emmetropia to -3D	31 (43.7%)	44 (44%)	
Myopia (3D to -8D)	25 (35.2%)	30 (30%)	
High myopia (over -8D)	5 (7%)	19 (19%)	

Values are presented as mean $\pm$ SD unless otherwise indicated.

Values are presented as n (%).

* p-value by Mann-Whitney U test

Here, we also compared initial operative method (Table 3). Next, PPV alone was performed in 21% (15 eyes) of the atopy group and 59% (59 eyes) of the control group. Likewise, buckling alone was performed in 17% (12 eyes) of the atopy and 31% (31 eyes) of the control. Encircling alone was performed 24% (17 eyes) in the atopy and 7% (7 eyes) in the control. And in 38% (27 eyes) of the atopy and 3% of the control, encircling and ppV were performed at the same time as an initial surgery. Therefore, in the atopic group, two procedures were performed together as an initial surgery, which was much more than the control group.

Table 3. Initial method of surgery in each group.

	Atopy	Non-atopy
Initial OP method		
Pars plana vitrectomy	15 (21%)	59 (59%)
Buckling	12 (17%)	31 (31%)
Encircling	17 (24%)	7 (7%)
ppV+Encircling	27 (38%)	3 (3%)
with phacoemulsification	11 (15%)	17 (17%)
with Pars plana lensectomy	4 (6%)	10 (10%)
	15 (21%)	27 (27%)

Values are presented as n (%).

* p-value by chi-square test

As the initial surgery, “encircling” accounted for 62% in the atopy group, and a note of being significantly more frequent than the control group (10%). In the control group, the most used operation method was ppV alone.

In this study, there were fifteen eyes of atopic patients (21%) who had cataract surgery at the same time with RD surgery, phacoemulsification in 11 eyes and pars plana lensectomy (ppL) in 4 eyes. In the control group, 27 eyes had cataract surgery together; with phacoemulsification in 17 eyes and ppL in 10 eyes.

The preoperative log MAR VA was 1.14 in the atopy group and 0.96 in control group, therefore there was no statistically significant difference in preoperative VA between two groups. However, the postoperative log MAR VA was 0.80 in the atopic group and 0.34 in control group; postoperative VA was markedly poor in the atopic group (P value 0.05). There were no statistically significant differences in the preoperative macular off ratio between the two groups. In this sense, the PVR rate was 35% in the atopy group and 12% in control group, and reoperation rate was 35% in the atopy group and 10% in control group. Therefore, PVR and reoperation rate were shown to be significantly higher in the atopy group (P value 0.000, 0.001 respectively),(Table 4).

Table 4. Pre-operative visual acuity and macula, PVR status & Post-operative visual & surgical prognosis of each group.

	Atopy	Non-atopy	P value
Pre op VA (Log MAR)	1.14	0.96	0.294
Post op VA (Log MAR)	0.80	0.34	0.005*
Macula ON: OFF (%)	34:37 (48:52)	44:56	0.615
Rate of PVR (%)	35%	12%	0.000*
Re-operation rate (%)	30%	10%	0.001*

*p-value by Mann-Whitney U test and chi-square test

In this context, the data of RD involving quadrant is present in Table 5. Here it was noted that RD was limited to one quadrant in 6 eyes (8.5%) in the atopy group, 9 eyes (9%) in control group. 56.3% in atopy group and 66% in control group occupied 2 quadrants. Next, it was revealed that there were 25.4% in the atopy group and 18% in control group occupied 3 quadrants. Finally, there was 9.9% in the atopy group and 7% in control group, which was shown to invade all four quadrants. In other words, it was noted that the differences between the two groups was not statistically significant (P value 0.213).

Table 5. Number of involved quadrants of RD.

	Atopy	Non-atopy	P value
Involved quadrant			0.213
1	6 (8.5%)	9	
2	40 (56.3%)	66	
3	18 (25.4%)	18	
4	7 (9.9%)	7	

Values are presented as n (%).

*p-value by Mann-Whitney U test

Additionally, the location of retinal breaks was analyzed at that time (Table 6-a). In the atopy group, retinal breaks were found in the superotemporal and inferotemporal areas as 34% and 30%, respectively. And in the control group, it was found to have breaks mainly in the superotemporal area (50%). The type

of retinal breaks was also analyzed (Table 6-b). The incidence of a horseshoe tear and retinal tear were observed in 30% and 28% of the atopic group and 35% and 27% of the control group, respectively. However, retinal dialysis was more frequent in the atopy group (16% in atopy group and 2% in control group), whereas the lattice hole was more observed in the control group (8% in atopy group, 21% in control group), (P value 0.000).

Table 6 -a. Location of breaks by fundus quadrant.

	Superotemporal	inferotemporal	superonasal	inferonasal	Unknown	P value
Atopy	24 (34%)	21 (30%)	6 (8%)	10 (14%)	10 (14)	
Non-Atopy	50 (50%)	21 (21%)	21 (21%)	6 (6%)	2 (2%)	
						0.001*

Values are presented as n (%).

*p-value by chi-square test

Table 6-b. Types of retinal break.

	Retinal dialysis	Horseshoe tear	Retinal tear	Lattice hole	Hole without lattice	Unknown	P value
Atopy	11 (16%)	21 (30%)	20 (28%)	6 (8%)	6 (8%)	7 (10%)	
Non-Atopy	2 (2%)	35 (35%)	27 (27%)	21(21%)	14 (14%)	1 (1%)	
							0.000*

Values are presented as n (%).

*p-value by chi-square test

In this study, twenty-eight eyes (39%) out of 71 eyes in an atopy group, and 26 eyes (26%) out of 100 eyes in a control group had undergone cataract surgery before the onset of detachment. In the atopy group, RD occurred 1.93 ± 0.48 years after cataract surgery. On the other hand, in the control group, RD occurred 4.86 ± 0.90 years after cataract surgery. Generally speaking, there was a significant difference of mean period after cataract surgery between the atopy group and control group (P value 0.002, Table 7). Notably, RD occurred within 6 months after cataract surgery in 9 eyes (32%) of 28 eyes in atopy group and 4 eyes (15%) of 26 eyes in control group (P value 0.154). RD within 1 year after cataract surgery was significantly common in atopy group; 17 eyes (60%) of 28 eyes in atopy group and 7 eyes (26%) of 26 eyes in control group (P value 0.013).

Table 7. Mean period after cataract surgery in patients who underwent cataract surgery before.

	Atopy	Non-atopy	P value
Mean period after cataract surgery (years)	1.93±0.48	4.86±0.90	0.002*
Within 1 year; n (%)	17 (60%)	7 (26%)	0.013*
Within 6 month; n (%)	9 (32%)	4 (15%)	0.154

Values are presented as mean ± SD unless otherwise indicated.

*p-value by Mann-Whitney U test

Discussion

We report in this study the characteristics of RD as associated with atopic dermatitis. Although there are some studies already reported the characteristics of atopic RD, this is the first report compared the characteristics of atopic RD with non-atopic RD.[2, 6, 7] Moreover, we compare the incidence of RD associated with cataract surgery, tear type or location in an atopy group and non-atopy group.

In Korea, the prevalence of atopic dermatitis is 2.2% of the total population, 6.9% of those under 18 years of age, 0.9% of those over 18 years of age. In this study, 2.7% of all RD patients had atopy, and there were 1.7 times more male patients than female patients in both groups. Although the prevalence of atopy itself is known to be no difference in relation to gender, male patients were more common than female patients of RD in this study.[13, 14] This result was similar to the study from Japan, which showed the incidence of atopy was not different according to sex of the patient but the rate of RD was nearly double in males. [15] Generally speaking, it was noted also in the control group, that male patients were more than female and it is also consistent with previous study which shows men were at a high risk for RD, whether exhibiting atopy or not.[13]

The incidence rate by age was the highest in the 50-60 age group in the control group and second highest in the 20s group, likewise previous study mentioned regarding the bimodal distribution of RD.[16] However, as noted in the atopy group, most of patients were teenagers or twenties. That is, the mean age of onset was 52 in the control group and 23 in atopy group, showing the age of onset in the atopy group was significantly younger (P value 0.000).

In previous studies, it was noted that the bilateral RD accounts for 5-10% of the total RD.[13] And in this study, 21% of the atopy group and 1% of the control group showed an indication of a bilateral

involvement of RD. Thus, the rate of bilaterality was significantly higher in the atopy group than control group.

There was no significant difference of the mean preoperative refractive index between two groups, but the proportion of high myopia patients with -8 diopters or more was 7% in the atopic group and 19% in the control group. The proportion of patients with high myopia was higher in the control group.

There was no difference of RD involving the quadrant or preoperative VA between the two groups. However, postoperative VA was shown to be significantly poorer in the atopy group (log MAR VA 0.80) than in the control group (log MAR VA 0.34), (P value 0.005). It shows that VA before surgery was similar, but the prognosis after surgery was significantly worse in the atopy group. It is thought to be due to inflammation caused by atopy itself, delayed wound healing, or increased PVR.

In the control group, the location of the retinal tear was most common in the superotemporal area. And followed by inferotemporal and superonasal area, it was shown to have occupied a similar rate. In the atopy group, the ratio of unknown was 14% high, as compared to 2% in control. Most of the tears noted in the atopy group were found in the temporal area, and showed a similar ratio in the superotemporal, inferotemporal area. It suggests that RD may occur due to frequent rubbing of the lateral side of eyes in atopy group. However, the temporal area was also common in the control group, and for this reason further study might be needed.

Chiefly noted, there was no difference in incidence of the right and left eyes. This result shows whether right-handed or left-handed might not be related to the site it where it occurs.

Interestingly, the type of tear was characteristically different in two groups. As was noted in the atopy group, retinal dialysis accounted for 16%, which was thus much higher than 2% in control group. Previous research has shown that the slapping of the eye acts as a trauma, resulting in retinal dialysis.[17]

Generally speaking, retinal dialysis is the disinsertion of the retina from the vitreous base, and is an uncommon cause of RD, accounting for 8% to 17% of the cases.[18, 19] Furthermore, a previous study suggested that retinal dialysis might be associated in many cases with trauma.(20, 21), and it shows that trauma caused by eyelid rubbing could be associated with atopic RD. Through this process, the horseshoe tear and retinal tear occupied a similar ratio in both groups, and lattice hole was more frequently found in the control group.

In this respect, PVR is a disease process that follows the proliferation of ectopic cell sheets in the vitreous and/or periretinal area, causing periretinal membrane formation and traction, in patients with RRD.[20] Previous studies show that this disease process occurs in 5%–10% of all RRD and is implicated in re-detachment after surgery in 75% of cases, remaining a major barrier to successful repair of RD.[21]. In our study, the PVR rate was 35% in atopy group and 12% in control group, indicating a statistically significant difference (P value 0.000). As mentioned above, RD with atopy generally thought to have association with eye rubbing, which often leads to poor peripheral retinal, and it may lead to more incidences of PVR.

Upon review, the previous study showed about 13% of patients needed reoperation after the single surgery of RD.[22],[23] In this study, the reoperation rate was 30% in the atopy group and it was 3 times more than that of the control group (10%), showing a statistically significant difference (P value 0.001).

Despite the similarity of macular off rate and preoperative VA between two groups, 38% of atopy group had vitrectomy and encircling together as an initial operative method, which was identified as much higher as compared to 3% in the control group. In this relation, the surgical method of vitrectomy and encircling together is usually performed in patients with severe PVR or retinal reattachment due to retinal dialysis. However, despite these aggressive treatments, both recurrence rate and postoperative visual prognosis were poor in the atopy group.[24]

At the time of RD occurs, the pseudophakic cases were 40% in the atopic group and 26% in the control group. It is emphasized that the mean time between the cataract surgery and onset of RD was 1.93 ± 0.48 years in atopy group and 4.86 ± 0.90 years in control group. Furthermore, it showed a statistically significant difference between the two groups. Especially, noting the RD within 1 year after cataract surgery was shown to be statistically significant, with an emphasis that 60% in the atopic group and 26% in the control group were revealed. This suggests that the risk of RD may increase after cataract surgery in atopy patients, especially up to a year post surgery.

Presumably it is noted that in phakic eyes, the movement of the vitreous body might be limited due to the lens, and in that case the progress of RD could be suppressed to a certain extent. But after the cataract surgery, these mechanisms might be broken and be more susceptible to becoming RD due to the trauma of eyelid rubbing. Also, atopic patients could be more vulnerable to RD due to their specific immune reaction, and the resulting degeneration of the vitreous body.

This study has some limitations. First, there might be a selection bias because we designed our study retrospectively. Second, the sample size in this case was small and follow-up period was relatively short, therefore we plan to analyze additional cases over time.

In conclusion, it is noted that atopic patients have RD in younger age and their prognosis is poor due to the high incidence of PVR or recurrence. Therefore, extensive treatment and management are needed in these instances. Moreover, we found that atopic patients have a much more increased risk of RD after cataract surgery. Thus, careful examination should be performed regularly after the cataract surgery especially in atopic patients for the best patient outcomes.

Declarations

Availability of data and materials

The datasets during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contribution

Youlim Lee and Young-Hoon Park were primarily responsible for experimental concept and design. Youlim Lee and Young-Hoon Park performed data acquisition and analysis, as well as drafting of the manuscript. Woo-kyung Park, Rae-Young Kim, Mirinae Kim, and Young-Gun Park were also involved in data analysis. All authors reviewed and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests.

Consent for publication

Not applicable.

Ethical approval and consent to participate

This study was performed according to the tenets of the Declaration of Helsinki, and the study protocol was approved by the institutional review/ethics boards of the Catholic University of Korea and our hospital. Informed consent was waived owing to the retrospective nature of this study, and patient records were anonymized prior to all records analysis. All protocols were approved by the Institutional Review and Ethics Boards of Seoul St. Mary's Hospital, South Korea.

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Figures

Figure 1

Age of patients. (%)