Risk factors and prognosis of pediatric rhegmatogenous retinal detachment in Egypt: a university hospital based study

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Abstract

● **AIM:** To study and compare the predisposing factors and clinical features of pediatric, adult, and elderly rhegmatogenous retinal detachment (RRD).
● **METHODS:** This is an observational analytic cross-sectional study in which patients with RRD admitted for surgery during 6mo period were divided into 3 age groups: pediatric (<18y), adult (18-60y), and elderly (>60y). Patients' demographic data, clinical features, RRD predisposing factors/features including myopia (axial length ≥26.5 mm), aphakia/pseudophakia, blunt trauma, peripheral retinal degenerations, history of RRD in the fellow eye, and surgical interventions/findings were recorded and analyzed.
● **RESULTS:** Totally 142 patients (142 eyes) were studied: 26 (18.31%) pediatrics, 86 (60.56%) adults, and 30 (21.13%) elderly. Elderly patients had a significantly higher intraocular pressures and cataracts compared to the other 2 groups (*P*=0.04). The RRD extent was larger in pediatric group (mostly 4 quadrants) compared to adults and elderly (mostly 2 quadrants), but it was not statistically insignificant (*P*=0.242). There were not statistically significantly differences in proliferative vitreoretinopathy (PVR) rate, posterior vitreous detachment (PVD) rate, number, site, shape, and size of breaks in three groups. All three groups had macular detachment in all eyes. Myopia and peripheral retinal degenerations were found to be more significant in adults (*P*=0.049, *P*=0.035, respectively), while blunt trauma was higher but insignificant in pediatric eyes (*P*=0.052). Pars plana vitrectomy (PPV) with silicone oil as a tamponade was the most used surgery in all groups.
● **CONCLUSION:** There are no significant difference in PVR rate in pediatric eyes but a significant higher rate of total RRD. Blunt trauma is more frequent in pediatrics eyes while myopia and/or peripheral retinal degenerations are more frequent in older ages. The rate of PPV as a choice for surgery is similar among all age groups.
● **KEYWORDS:** rhegmatogenous retinal detachment; pediatric; predisposing factors; proliferative vitreoretinopathy; peripheral retinal degenerations

INTRODUCTION

R hegmatogenous retinal detachment (RRD) in children is a challenging rare disease with an incidence of about 0.5 cases per 100 000[1]. These pediatric RRD differ from adult RRD in anatomical characteristics, etiology, management, and prognosis[2]. In general, children and adolescences with RRDs are to present later than adults with worse visual acuity, higher likelihood of macular involvement and proliferative vitreoretinopathy (PVR), lower rates of reattachment, and worse overall surgical success rates[3-5]. Additional challenges found in the pediatric age group are posed by the presence of systemic comorbidities as prematurity and connective tissue disorders, poor younger children cooperation during examinations, the difficulty with postoperative positioning, bilateral detachments, and a relatively high rate of trauma[6-9]. Despite the difficulty in managing these cases, successful reattachment of the retina is possible in the majority of cases[10-13].

While most retinal detachments in the adult population are related to myopia and posterior vitreous detachment (PVD), previous reports have highlighted the etiology in pediatric age group to be trauma, myopia, previous intraocular surgery and congenital or developmental anomalies being the most

common predisposing factors[14-16]. Different types of retinal breaks can be found in eyes with pediatric RRD, including horseshoe tears, giant retinal tears, atrophic holes, and retinoschisis with ora serrata dialysis found more commonly in the pediatric age group in about 20%-42%[9]. In a previous study of pediatric RRD cases, a larger percentage of patients with dialysis had final reattachment compared to those with giant retinal tears and tractional retinal tears[11-12].

The surgical treatment approach is at the discretion of the surgeon based on certain findings of examination like PVR. In eyes without advanced PVR, scleral buckle (SB) is usually the first procedure. Primary vitrectomy is often performed in eyes with advanced PVR, opaque media, or a posterior tear[7-8,14]. Adherence to the position after the application of gas tamponade is quite difficult for young children and thus the use of silicone oil resolves this issue, but may lead to a worse visual and anatomical rate of success and more postoperative complications[14]. The different causes for retinal detachment, associated ocular pathologies, and occurrence of postoperative complications may be attributed to the worse anatomical and functional outcomes in children rather than the number of interventions[15-16].

In this study, we aim to compare pediatric and adult RRDs' clinical characteristics, etiology, and initial repair techniques. Herein, we analyze a group of patients managed at a single tertiary university hospital that treats a predominantly Egyptian population in central Cairo. To our knowledge, no series of Egyptian populations with this pathology have analyzed the different predisposing and risks factors. In doing so, we hope to provide contemporary data regarding the etiologies and different risk factors involved in pediatric RRDs versus adults RRDs that may help develop strategies for better management in these cases.

SUBJECTS AND METHODS

Ethical Approval This observational analytic cross-sectional study was conducted in accordance with Declaration of Helsinki and received approval from the Institutional Review Board (IRB; Cairo University IRB number: 2014-01-15). All patients received a thorough explanation of the study design and aims. Study participants gave informed consent before initiation of any study-related procedures.

Patient Selection

Inclusion criteria and study groups All patients with RRD admitted to the university hospital for surgical intervention during a 6mo period were included. That included as well RRD with history of blunt ocular/head trauma, and history of previous uneventful phacoemulsification. The included subjects were divided into three study groups: pediatric group (<18y), adult group (18-60y), and elderly group (>60y).

Exclusion criteria Subjects were excluded if they had

previous intraocular surgeries other than uneventful phacoemulsification, penetrating ocular trauma in the presenting eye, patient refused to be included, any other ocular pathologies, retinal breaks without RRD or symptoms, subclinical RRD which could be treated by laser, and/or other types of RRD as exudative and tractional.

Study Parameters

Demographic data Patients' demographic data including age and gender were recorded.

Vision and anterior segment examination All patients were subjected to visual acuity measurements, slit lamp examination recording the lens status, and applanation tonometry.

Clinical features of RRD A detailed fundus examination (through a dilated pupil) using binocular indirect slit-lamp biomicroscopy and indirect ophthalmoscopy with scleral indentation was accomplished, and a retinal chart was drawn for each case showing the following: extent and configuration of RRD, macular involvement, retinal breaks (number, distribution, shape and size), PVR was graded according to the revised grading system of PVR[17] and judged pre-operatively and confirmed intra-operatively, the presence or absence of total PVD was judged pre-operatively but confirmed intra-operatively.

Predisposing factors for RRD The following predisposing factors for RRD were recorded: myopia (axial length≥26.5 mm), aphakia/pseudophakia, blunt trauma, lattice and other peripheral retinal degenerations, history of RRD in the fellow eye.

Operative data Type of surgical procedure: whether SB, pars plana vitrectomy (PPV), combined SB/PPV or pneumatic retinopexy. Type of intraocular tamponade used (silicone, gas, or air). Phacoemulsification cases undergoing combined phacoemulsification with PPV.

Statistical Analysis Statistical analysis was done using Statistical Package for the Social Sciences (SPSS) computer software package (version 21.0, 2012 Echosoft Corporation, USA). Qualitative data were expressed as frequencies and percentages. Quantitative data were expressed as mean±standard deviation (SD) for parametric data and median (interquartile range; IQR) for non-parametric data. Differences between groups were assessed through Mann-Whitney U test for 2 groups and Kruskal-Wallis test for more than 2 groups, for non-parametric data. Chi-square (χ^2) test was performed for comparing categorical data. Exact test was used instead when the expected frequency is less than 5. All tests were two tailed and considered significant at $P<0.05$ and highly significant at $P<0.01$.

RESULTS

During the 6mo study, we had 267 RRD surgery procedures of which only 142 eyes of 142 patients with RRD were included

Table 1 Demographic data and anterior segment findings *n* (%)

Parameters	Pediatric group (*n*=26)	Adult group (*n*=86)	Elderly group (*n*=30)	*P*
Male	14 (53.8)	50 (58.1)	24 (80.0)	0.277
Female	12 (46.2)	36 (41.9)	6 (20.0)	
IOP, mean±SD	9.71±1.38	9.91±2.76	13.07±2.96	0.040
Lens status				<0.001
Clear	16 (61.5)	38 (44.2)	2 (6.7)	
Cataract	8 (30.8)	28 (32.6)	18 (60.0)	
Aphakia	2 (7.7)	0	4 (13.3)	
PCIOL	0	18 (20.9)	0	
ACIOL	0	2 (2.3)	6 (20.0)	

IOP: Intraocular pressure in mm Hg; PCIOL/ACIOL: Posterior/anterior chamber intraocular lens.

in the current study: 26 patients (18.31%) in pediatric group, 86 patients (60.56%) in adult group, and 30 patients (21.13%) in elderly group.

Demographic Data The RRD patients' mean age was 45.65±18.56y (range: 3-80y), with 88 males (61.97%). There was no sex predilection for each of the three age groups (*P*=0.221; Table 1).

Anterior Segment Findings Sixty-four (45.1%) eyes in the three groups were phakic, with 8 (57.1%) of the pediatric group having clear lens, while 14 (58.3%) of the elderly being cataractous (*P*<0.001). The pre-operative mean IOP was 10.62±2.99 mm Hg (range 3-20 mm Hg) which was statistically significantly higher in elderly (*P*=0.040; Table 1).

Rhegmatogenous Retinal Detachment Features

Retinal detachment extent and macular involvement Retinal detachment was more frequent in pediatrics, 12 eyes (46.2%) involved in 4 quadrants, 24 eyes (27.9%) in adults, and 4 eyes (13.3%) in elderly, but it was not statistical significance (*P*=0.242; Table 2).

Retinal breaks No breaks were detected in 48 eyes (33.8%), only 1 break in 54 eyes (38%), 2 breaks in 26 eyes (18.3%), 3 breaks in 8 eyes (5.6 %), 4 breaks in 4 eyes (2.8 %), and 5 breaks in 2 eyes (1.4%). In each of the three groups, most of the eyes had one or no detectable retinal breaks, but with no statistically significant difference (*P*=0.512; Table 2). Seventy-four eyes (52.1%) had peripheral breaks, 16 eyes (11.26%) had macular breaks, while 4 eyes (2.8%) had both peripheral and central breaks. Peripheral breaks were the most common type in the three groups [14 eyes (70%), 46 eyes (79.3%) and 14 eyes (87.5%), respectively]. The shape of retinal breaks varied among horseshoe tears (29.5%), holes (23.9%), slit (2.8%), retinal dialysis (5.63%), and giant tears (4.22%). In three groups, retinal tears horseshoe and round holes [10 eyes (55.6%) and 6 eyes (33.3%) in pediatrics, 26 eyes (44.8%) and 20 eyes (34.5%) in adults, and 6 eyes (37.5%) and 8 eyes (50%) in elderly] were more frequent than other breaks (Table 2).

The size of the breaks ranged from 0.50 to 3.50 clock hours with a mean of 1.75±1.50 in pediatrics, 0.25 to 3.50 clock hours with a mean of 0.09±0.81 in adults and 0.50 to 4.00 clock hours with a mean of 1.06±1.21 in elderly (*P*=0.660). The size of lattice degeneration in adults ranged from 1 to 4 clock hours with a mean of 1.67±0.98 (Table 2).

PVD and PVR grade Out of the 142 eyes, 20 eyes (14%) had PVD, with no statistically significant difference in three groups (*P*=1.00). Regarding the grade of PVR, 94 eyes (66.2%) had grade A, 26 eyes (18.3%) had grade B, and 22 eyes (15.4%) had grade C. In each of the three groups, PVR grade A was the most common [14 eyes (53.8%), 60 eyes (69.8%) and 20 eyes (66.7%), respectively], but with no statistically significant difference (*P*=0.711; Table 2). Although there was no statistical significance difference but there was a trend towards a higher rate of PVR grade B/C in pediatric age group (46.2%) compared to adults (30.2%) and elderly (33.3%).

Predisposing Factors for Rhegmatogenous Retinal Detachment Myopia was found in 4 patients (15.4%) of pediatric group, and in 44.2% of adults, which was found statistically significant (*P*=0.049), while peripheral retinal degenerations in 4 eyes (15.4%) of pediatric group, and 44.2% of adults (*P*=0.035; Table 3). In elderly, 10 eyes (33.3%) had aphakia as risk factor. Blunt trauma was more frequent in pediatrics [12 eyes (46.2%) compared to 18 eyes in adults (20.9%) and 2 eyes in elderly (6.7%)], with borderline significance (*P*=0.052; Table 3).

Operative Data

Type of surgical procedure PPV was done for 122 eyes (86%), of which 64 eyes had undergone phaco-vitrectomy (45%), SB was done for 16 eyes (11.2%), and pneumatic retinopexy was done for 4 eyes (4.7%). In each group, PPV was the most used surgery for retinal re-attachment [20 eyes (76.9%), 72 eyes (83.7%) and 30 eyes (100%), respectively]. No cases received combined SB/PPV in any group. PPV was combined with phacoemulsification in 18 (60%) eyes of elderly (Table 4).

Table 2 Clinical features of retinal detachments in three groups   *n* (%)

Parameters	Pediatric group (*n*=26)	Adult group (*n*=86)	Elderly group (*n*=30)	*P*
Retinal detachment extent				0.242
1 quadrant	2 (7.7)	0	0	
2 quadrants	6 (23.1)	34 (39.5)	14 (46.7)	
3 quadrants	6 (23.1)	28 (32.6)	12 (40.0)	
4 quadrants	12 (46.2)	24 (27.9)	4 (13.3)	
Macular detachment	24 (92.3)	80 (93.0)	30 (100.0)	0.628
Breaks number				0.512
0	6 (23.1)	28 (32.6)	14 (46.7)	
1	10 (38.5)	34 (39.5)	10 (33.3)	
2	8 (30.8)	16 (18.6)	2 (6.7)	
3	0	6 (7.0)	2 (6.7)	
4	0	2 (2.3)	2 (6.7)	
5	2 (7.7)	0	0	
Breaks shape				0.813
Horseshoe	10 (55.6)	26 (44.8)	6 (37.5)	
Hole	6 (33.3)	20 (34.5)	8 (50.0)	
Slit	0	4 (6.9)	0	
Dialysis	4 (22.2)	4 (6.9)	0	
Giant	0	4 (6.9)	2 (12.5)	
Breaks distribution				0.700
Macular	6 (30.0)	8 (13.8)	2 (12.5)	
Peripheral	14 (70.0)	46 (79.3)	14 (87.5)	
Both	0	4 (6.9)	0	
Break size[a], mean±SD	1.75±1.50	0.09±0.81	1.06±1.21	0.660
Lattice size[a], mean±SD	-	1.67±0.98	-	0.606
PVD	2 (14.3)	14 (16.3)	4 (13.3)	1.00
PVR				0.711
Grade A	14 (53.8)	60 (69.8)	20 (66.7)	
Grade B	8 (30.8)	14 (16.3)	4 (13.3)	
Grade C	4 (15.4)	12 (14.0)	6 (20.0)	

[a]Size in clock hours. PVR: Proliferative vitreoretinopathy; PVD: Posterior hyaloid detachment.

Table 3 The incidence of each predisposing factor in three groups   *n* (%)

Parameters	Pediatric group (*n*=26)	Adult group (*n*=86)	Elderly group (*n*=30)	*P*
Predisposing factors				
None	14 (53.8)	14 (16.3)	12 (40.0)	0.070
1 factor	8 (30.8)	32 (37.2)	14 (46.7)	
2 factors	4 (15.4)	28 (32.6)	4 (13.3)	
3 factors	0	12 (14.0)	0	
Myopia	4 (15.4)	38 (44.2)	4 (13.3)	0.049[a]
Aphakia	2 (7.7)	20 (23.3)	10 (33.3)	0.295
Blunt trauma	12 (46.2)	18 (20.9)	2 (6.7)	0.052
Lattice degeneration	2 (14.3)	24 (27.9)	2 (6.7)	0.218
Other retinal degeneration	4 (15.4)	38 (44.2)	4 (13.3)	0.035[a]
Fellow eye RD	4 (15.4)	10 (11.6)	2 (6.7)	0.765

RD: Retinal detachment. [a]*P*<0.05 are considered statistically significant.

Intraocular tamponade Silicone oil as an intraocular tamponade was used for 120 eyes (84.5%), gas was used for 6 eyes (4.2%), while air was used for 16 eyes (11.26%). In each group, silicone oil was the most used tamponading agent [20 eyes (76.9%), 70 eyes (81.4%) and 30 eyes (100%), respectively; Table 4].

Table 4 Operative data in three groups				n (%)
Parameters	Pediatric group (n=26)	Adult group (n=86)	Elderly group (n=30)	P
Surgery				0.296
Pars plana vitrectomy	20 (76.9)	72 (83.7)	30 (100.0)	
Scleral buckle	6 (23.1)	10 (11.6)	0	
Pneumatic retinopexy	0	4 (4.7)	0	
Phaco-vitrectomy	8 (30.8)	38 (44.2)	18 (60.0)	0.313
Tamponade				0.256
Silicone oil	20 (76.9)	70 (81.4)	30 (100.0)	
Gas	0	6 (7.0)	0	
Air	6 (23.1)	10 (11.6)	0	

DISCUSSION

The clinical features and predisposing factors of RRD in different age groups is not well documented in the literature. In our study, we investigated and compared these features in three groups: pediatric, adult, and elderly. We found most of the eyes in each of the three age groups were phakic, with 61.53% of the pediatric age group having clear lens, while 60% of the elderly being cataractous ($P<0.001$) but when lens status was studied in males and females, we found that the difference was statistically significant between pediatric and elderly age groups ($P=0.004$) while it was not significant in females ($P=0.198$).

In our patients, most of the eyes in the pediatric age group had 4 quadrants RRD (46% of the group), while in adults (39.5% of the group) and elderly (46.7% of the group) they were mostly 2 quadrants but with no statistically significant difference ($P=0.242$). This difference even being non-significant could be due to late diagnosis of RRD in pediatrics compared to adults. This emphasizes the importance of regular follow up and thorough examination of our children with risk factors of RRD.

In addition, in our study most of cases were diagnosed with their maculae off (94.5%) without significant difference in the three groups being studied. Within the pediatric age group, the percentage of macular involvement was about 92% which was higher compared to the study made by Tsai et al[18] being 68% (taking in consideration that this was retrospective study included 30 eyes with pediatric RRD). In the three groups most retinal tears were horseshoe or round holes, and most of the eyes had one or no detectable retinal breaks, but with no statistically significant difference. In each of the three age groups, the PVR was grade A in most eyes, with no statistically significant difference between groups. In the pediatric age group we found 54% of our cases having PVR grade A (which was the highest percentage) which in contrary to Nuzzi et al[1] retrospective study including more than 20 children; they found that the highest percentage of children with RRD had PVR >grade C. Although there were no statistical significance

but there was trend of a higher rate of PVR B/C in pediatric age group (46.2%) compared to adults (30.2%) and elderly (33.3%). This is a known difference between pediatric and adult RRDs in previous reports, despite not reaching significant values in our study due to a relatively smaller number of eyes in each group.

There are no previous studies comparing the incidence of predisposing factors in different age groups, which is one of our main outcomes on which we focused on and tried to analyze in our study. We compared the 3 age groups regarding several predisposing factors like myopia, lattice, and other peripheral retinal degenerations, aphakia, history of blunt ocular trauma, and lastly history of RRD in the fellow eye. Myopia was significantly more common in adults (36.2%) than pediatrics (15.4%, $P=0.049$), and peripheral retinal degenerations more in adults (44.2%) than pediatrics (15.4%, $P=0.035$). Blunt trauma was more frequent in pediatrics (46.2%) compared to adults (20.9%) and elderly (6.7%), with borderline significance ($P=0.052$). Again, not reaching a statistically significant value due to the smaller number of eyes doesn't abolish the obvious trend towards higher rate of blunt trauma in children as a history. Nuzzi et al[1] found that ocular trauma in the paediatric is significantly more frequent as compared to adults, with a higher prevalence in the male population. We also found that the percentage of idiopathic RRD in the pediatric age group was about 54% which was by far higher than reported by Starr et al[19] and was only 20% of all pediatric RRD.

There are several good reasons to approach pediatric RRD with an SB. The pediatric vitreous is more rigid and formed; and the posterior hyaloid and rest of the vitreous is more firmly adherent to the retinal surface[20]. In cases with broad peripheral pathology, once the traction has been relieved with buckling, the vitreous itself can tamponade the break, allowing easier fluid resorption. These features may improve the tamponade effect achieved with scleral buckle and may make vitrectomy less effective at alleviating vitreoretinal traction. In PPV cases, vitreous that is left near the break often contracts, leading

to recurrence, and strong vitreoretinal adhesion and limited areas of PVD in children make PPV more difficult and less effective at alleviating vitreoretinal traction[21]. Additionally, vitrectomy is associated with a higher rate of cataract formation compared to SB, and because of amblyopia risk and loss of accommodation, pediatric cataracts are considerably more morbid. Thus, approaches that minimize cataract risk are preferable[22].

Patients who initially received SB or SB/PPV were proved to have better long-term outcomes when compared to PPV. This had been reported previously by multiple authors[23]. Use of SB alone in many situations might have been reserved for milder cases, and patients who undergo primary SB usually lack posterior tears, significant PVR, are phakic without lens opacity and trend toward younger ages. Despite the fact that SB should be an integral part of our armentarium in managing pediatric rhegmatogenous retinal detachments, we found in each of our study age groups that PPV with or without phacoemulsification was the most commonly used surgery for retinal re-attachment and this agrees with most of the previous studies in literature due to the large decrease in sclera buckling operations nowadays with the continuous and accelerated evolution in vitrectomy settings in the last decades[20-23].

It must be highlighted that in our study, we did not analyze the relationship between the different demographic, systemic, and ocular risk factors, and the functional and anatomical outcomes of such eyes in any of the 3 investigated groups. Our study is a descriptive one, where we describe and compare the patients' baseline features and known risk factors of RRD, and as well as the different surgical procedures performed to each group. It should also be clear that the choice of surgery will still be dependent on the surgeon own surgical experience and knowledge, in addition to the available surgical settings.

In this study we found the pediatric age group to have a trend toward a higher rate of total RRD compared to adults and elderly. In addition, there were not statistically significantly differences in the rate of PVR or PVD between groups. Myopia and peripheral retinal degenerations were found to be significant higher in adults while blunt trauma showed a higher non-significant rate in pediatric eyes. Pars plana vitrectomy with silicone oil as a tamponade was the most used surgery in all age groups.

Although the study has several strength points as being prospective, it still has some limitations mainly the sample size with a relatively small number of eyes in each group. This may have been the reason why some of the findings didn't reach a statistically significant value despite the obvious observable trends as higher rate of PVR at presentation in children as well as higher rate of blunt trauma as etiology. Another limitation is the absence of a longer postoperative follow up

visits to document and analyze the results of different surgical techniques. It is recommended at this stage to conduct larger studies to better understand the predisposing factors and risks of developing pediatric RRDs to help improve their management.

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