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PERIPHERAL RETINAL FINDINGS IN HIGHLY MYOPIC CHILDREN ≤10 YEARS OF AGE

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Abstract

Purpose—The purpose of this study was to characterize the peripheral retinal findings in highly myopic young children without other known risk factors for retinal detachment.

Methods—A retrospective review of all cases of children ≤10 years of age with high myopia (>6.00 diopters) who were evaluated for presumed risk of retinal detachment by either an examination under anesthesia or office examination by a single retina specialist from January 2001 through December 2008. Patients with regressed retinopathy of pre-maturity, retinal detachment in the fellow eye, or known Stickler syndrome were excluded.

Results—Fifty-four eyes of 30 patients with high myopia were examined. Twenty-six eyes of 14 patients were examined under anesthesia because of the examiner's inability to adequately visualize the peripheral retina during an office examination. Mean age at examination was 6 ± 3 (range, 1–10) years. Mean spherical equivalent refractive error was −13.88 ± 3.79 (range, −6.00 to −25.00) diopters. Peripheral retinal findings were identified in 33% of eyes, the most common being lattice degeneration (20%), white without pressure (11%), and retinal holes with subretinal fluid (4%).

Conclusion—Approximately one third of highly myopic children in our study showed peripheral retinal findings. If the peripheral retina is not adequately visualized during an office evaluation, examination under anesthesia should be considered.

Keywords

high myopia; fundus features; peripheral retina; lattice degeneration; retinal detachment; retinal holes; white without pressure; examination under anesthesia; pediatric

Although isolated high myopia (>6 diopters) in children ≤10 years of age is rare,[1–5] it is the most common factor associated with nontraumatic pediatric rhegmatogenous retinal detachment (RRD) and is a significant cause of visual disability.[6,7]

Risk factors for the development of RRD include peripheral retinal abnormalities such as lattice degeneration, retinal holes, and tears.[8] Although peripheral retinal features in highly myopic adults have generally been well characterized,[9–12] there are no studies that

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specifically describe the peripheral retinal findings in highly myopic children ≤10 years of age.

Compared with adults, children with retinal detachments are less likely to report symptoms, present later with more chronic detachments, have worse surgical and visual outcomes, and are more difficult to examine in an office setting.[13–17] Given these differences, the prevention of retinal detachment in children carries even more urgency than in adults. The goals of this study are to characterize the peripheral retinal findings of highly myopic children and to determine if there is value in examining such children under anesthesia to identify peripheral retinal pathology when there is an incomplete view of the retinal periphery during examination in the office. To this end, we reviewed the peripheral retinal findings in highly myopic (>6 diopters) children ≤10 years of age who underwent either an office examination or examination under anesthesia (EUA) for presumed risk of RRD.

Methods

We retrospectively reviewed the charts of all children ≤10 years of age with high myopia (>6.00 spherical diopters) who underwent either an EUA or office examination for presumed risk of RRD between January 2001 and December 2008. One vitreoretinal surgeon (G.B.H.) conducted all examinations at either the Emory Eye Center or Egleston Children's Hospital. This study was approved by the Emory University Institutional Review Board. Patients were excluded if they were known to have retinopathy of prematurity, Stickler syndrome, retinal detachment in the fellow eye, or ocular trauma.

Patient age, sex, ocular history, presence or absence of symptoms, family history of RRD, visual acuity (when feasible), and spherical refractive error were recorded. Dilated fundoscopic examination was performed using indirect ophthalmoscopy with scleral indentation. Patients were examined under anesthesia in the operating room when office examination yielded either a suspicious lesion or there was an inadequate view of the retinal periphery. Fundus findings recorded included peripheral retinal, macular, and optic disk abnormalities. After informed consent was obtained, laser indirect ophthalmoscopy was used to treat lesions deemed clinically suspicious by the examiner (G.B.H.).

Mean, standard deviation, and range were recorded for continuous variables. Visual acuity was transformed to logarithm of the minimum angle of resolution notation. Student's *t*-test was used to determine significance between groups.

Results

Fifty-four eyes of 30 patients referred for risk of RRD were included for analysis. Twenty-six eyes (48%) were examined under anesthesia. Thirty-three eyes (61%) were eyes of boys. Mean age of patients examined under anesthesia was significantly younger than those examined in the office (5 ± 3 [1–10] years vs. 7 ± 2 [2–10] years, $P = 0.01$). Mean spherical equivalent refractive error for the group was −13.88 ± 3.79 (−6.00 to −25.00) diopters. Mean logarithm of the minimum angle of resolution visual acuity was 0.561 ± 0.354 (range, 0.000–1.301) for 45 eyes (Snellen equivalent ~ 20/70). There was no significant difference in refractive error or visual acuity between the eyes examined under anesthesia and those examined in the office (Table 1). Two patients had nonlocalized photopsias (discussed in the case reports). Six patients (20%) had amblyopia and 3 (10%) had strabismus. Two patients (7%) had a family history of RRD.

Peripheral retinal abnormalities were identified in 18 eyes of 11 patients (33%). Lattice degeneration was the most common peripheral retinal lesion identified (11 eyes of 7 patients, 20%), followed by white without pressure (6 eyes of 4 patients, 11%). Two eyes of

2 patients (4%) showed a retinal hole with subretinal fluid, and 1 eye (2%) had a vitreoretinal tuft (Table 2).

Among the 26 eyes of patients undergoing EUA, 21 eyes had an initial office examination yielding an inadequate view of the retinal periphery, whereas 5 eyes showed a suspicious lesion in the office examination. Of the 21 eyes with an inadequate view of the retinal periphery in the office examination, EUA identified 5 eyes with lattice degeneration. Among the 5 eyes with a suspicious lesion in the office examination, 2 eyes of 2 patients showed a retinal hole with subretinal fluid (discussed in the case reports), 2 eyes of 2 patients showed white without pressure, and 1 eye had an epiretinal membrane. In this latter patient with an epiretinal membrane, EUA identified a peripheral vitreoretinal tuft.

Prophylactic laser retinopexy was performed in 5 eyes of 4 patients: both eyes of 1 patient with bilateral lattice degeneration, 2 eyes of 2 patients with retinal holes with subretinal fluid, and 1 patient with unilateral high myopia with a vitreoretinal tuft.

Disk abnormalities consisting of peripapillary atrophy, myopic crescent, posterior staphyloma, and tilted disks were found in 39% of all eyes. Macular abnormalities were identified in 17% of the eyes and included retinal pigment epithelium changes, scar, epiretinal membrane, macular hole, and falciform fold. Fourteen of 54 eyes (26%) showed more than one fundus finding (either peripheral retinal, macular, or disk). Normal ocular fundi were observed in 16 eyes of 10 patients (30%) (Table 2).

Eyes showing peripheral retinal abnormalities were statistically more myopic compared with eyes with a normal peripheral retina (−15.00 ± 3.80 [−6.75 to −21.75] vs. −12.67 ± 2.85 [−6.00 to −19.00] diopters, $P = 0.02$). Eyes undergoing EUA were more likely to have peripheral retinal abnormalities identified compared with eyes with an office examination (46 vs. 21%).

Case Report 1

A 9-year-old girl was referred for evaluation of high myopia and nonlocalized photopsias. Her spherical refractive error was −7.75 in her right eye, and −18.25 in her left eye. She had received a previous in-office examination at the age of 4 and the results of that examination were normal. At presentation, the initial office examination showed white without pressure only in her right eye and an inferior retinal hole with subretinal fluid in her left eye. Because of this suspicious lesion, she underwent EUA for a more thorough examination and laser retinopexy around the retinal hole.

Case Report 2

A 10-year-old boy was referred for evaluation of high myopia and nonlocalized photopsias. His spherical refractive error was −17.25 in both eyes. An in-office examination showed an inferior retinal hole with subretinal fluid and temporal lattice in his right eye and nasal white without pressure in his left eye. Because of these suspicious lesions, the patient was scheduled for an EUA and laser retinopexy of his right eye within 4 weeks. Before EUA, however, the patient presented with decreased vision in his left eye and was found to have a macula-involving RRD with a giant retinal tear in his left eye. The patient underwent scleral buckle and pars plana vitrectomy of his left eye and also prophylactic laser retinopexy of the retinal hole and lattice in his right eye. No peripheral retinal pathology such as lattice was identified in the eye with the retinal detachment at the time of surgery.

Discussion

In this study of highly myopic children ≤10 years of age, we found peripheral retinal abnormalities in approximately one third of the eyes and lattice degeneration in 20% of the eyes. Although the peripheral retinal findings of adults with high myopia have been well described, we are unaware of any other studies characterizing peripheral retinal pathology in young children with high myopia. In adults with high myopia, previous studies have shown a variable prevalence of lattice degeneration. Karlin and Curtin9 showed an increased prevalence of lattice degeneration with increased axial length in adult myopic eyes with an overall incidence of 6.1%. Pierro et al12 found lattice degeneration in 13.2% of eyes with an axial length greater than 24 mm (13–82 years). Celorio and Pruett[11] identified lattice degeneration in 24.1% of eyes with greater than 6 diopters of myopia (10 –72 years). Recently, Lai et al10 reported that 13.6% of adult eyes in China with greater than 6 diopters of myopia had lattice degeneration.

Whether to treat lattice degeneration in adult eyes has previously been a source of controversy. Lattice lesions are present in a high proportion of eyes with retinal detachment, [8,18] and in the 1970s and 1980s, treatment of such lesions was generally favored. In a long-term natural history study, however, Byer[19] showed that in 423 adult eyes with lattice degeneration followed for an average of >10 years, retinal detachment occurred in only 0.7%. He concluded that prophylactic treatment of lattice should be discontinued in phakic eyes if the fellow eye has no history of RRD. Treatment of lattice in fellow eyes of patients with RRD was shown by Folk et al[20] to reduce the risk of retinal detachment in the second eye from 5.1% to 1.8%. Despite this finding, the authors made no strong recommendation regarding prophylactic treatment of fellow eyes, citing the fact that 100 eyes would have to be treated to prevent 3 detachments. In light of the success rate of retinal reattachment surgery ranging >90%, routine treatment of lattice in adult fellow eyes is not considered justified.[21] In fact, in a consensus review of the literature regarding prophylactic treatment for peripheral retinal pathology in adults, there was sufficient data to support the treatment only of symptomatic flap tears.[22]

Young highly myopic children, however, pose an exceptional clinical dilemma. Children are less likely to report symptoms and the diagnosis of RRD is often delayed. Consequently, retinal detachments in children may be more chronic and have more proliferative vitreoretinopathy, thereby resulting in poorer surgical and visual outcomes.[13–17] Interestingly, this study showed that only two children were symptomatic, and these children were the oldest in our cohort. Moreover, we know that myopia is the most common cause of nontraumatic RRD in children,[6–7] and that lattice degeneration increases with myopia.[9] Finally, children are more difficult to examine in the office, and a thorough examination of the peripheral retina is not possible without general anesthesia in many cases. In fact, our study shows that EUA identified lattice degeneration in 5 of 21 eyes that initially was not seen during an in-office examination. Given these differences in the pediatric population, especially in children ≤10 years of age, EUA with prophylactic treatment of lesions predisposing to retinal detachment may be warranted in some cases.

Four patients in this study received prophylactic laser: one patient with bilateral lattice, two patients with retinal holes, and one patient with a vitreoretinal tuft. Most patients had only one documented examination available for review; therefore, no recommendation regarding the long-term benefit of treatment can be made from this study. These data do, however, show that approximately one third of highly myopic young children have potentially significant peripheral retinal pathology that may warrant treatment.

This study has several limitations inherent in a retrospective analysis. First, while we excluded patients with other known risk factors for RRD in addition to primary myopia, the patient population may include some patients with Stickler syndrome or other hereditary vitreoretinopathies along with isolated myopia. The diagnosis of Stickler syndrome often cannot be made based on one or two visits for any given individual, and molecular testing for Stickler mutations is not practical for many patients for financial reasons. Although the inclusion of some patients with occult Stickler syndrome or other hereditary abnormalities in addition to primary myopia may make our study population somewhat heterogeneous, it also makes it representative of “real world” clinical experience. Second, the criteria for selecting children for EUA were not uniform. As would be expected, children in the EUA group were younger than children examined in the office, which intuitively reflects that younger children cannot cooperate as well as older children in the office. In addition, the EUA group had a greater number of peripheral retinal abnormalities, which may simply be because a more thorough examination is possible when the patient is under anesthesia. It is possible that if more children had undergone EUA in this series, even more lattice or other lesions may have been identified. Furthermore, there were no uniform criteria for treating peripheral retinal lesions.

In conclusion, in conducting this study, we hoped to gain insight into whether EUAs in highly myopic children ≤10 years of age are worthwhile. Indeed, we identified a high prevalence of peripheral retinal abnormalities by EUA in this patient population. Although prophylactic treatment of these lesions in adults is generally not recommended, treatment may be warranted in some children. Given the small sample size, lack of uniform criteria for treatment, and limited follow-up, this study does not answer whether prophylactic treatment is beneficial in this population. Long-term studies would be required to determine the natural history of such lesions in this unique patient population and also whether there is benefit in prophylactic treatment to prevent retinal detachment.

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Table 1

Demographics

Demographics	EUA	Office Examination	Both EUA and Office Examination
Total number eyes (patients)	26 (14)	28 (16)	54 (30)
Patients with unilateral myopia	2	4	6
Number of male eyes	17	16	33
Mean age at examination (years)	5 ± 3 (range, 1–10)	7 ± 2 (range, 2–10)	6 ± 3 (range, 1–10)
Mean spherical equiv. (D)	−14.47 ± 3.96 (−6.00 to −21.75)	−13.33 ± 3.60 (−7.25 to −25.00)	−13.88 ± 3.79 (−6.00 to −25.00)
Mean VA (logMAR)	0.534 ± 0.293 (0.097–1.301)	0.581 ± 0.398 (0.000–1.301)	0.561 ± 0.354 (0.000–1.301)

D, diopters; VA, visual acuity; logMAR, logarithm of the minimum angle of resolution.

Table 2

Fundus Findings in Highly Myopic Children ≤ 10 Years of Age

	EUA (n = 26 eyes)		Office Examination (n = 28 eyes)		Total (n = 54 eyes)	
Fundus Findings	**No. Eyes**	**Total (%)**	**No. Eyes**	**Total (%)**	**No. Eyes**	**Total (%)**
Any peripheral lesion	12	46.2	6	21.4	18	33.3
Lattice degeneration	6	23.1	5	17.9	11	20.4
White without pressure	5	19.2	1	3.6	6	11.1
Retinal hole with subretinal fluid	2	7.7	0	0.0	2	3.7
Vitreoretinal tuft	1	3.8	0	0.0	1	1.9
Any vitreous lesion	0	0.0	4	14.3	4	7.4
Vitreous veils	0	0.0	3	10.7	3	5.6
Posterior vitreous detachment	0	0.0	1	3.6	1	1.9
Disk findings	8	30.8	13	46.4	21	38.9
Macular findings	6	23.1	3	10.7	9	16.7
Normal	7	26.9	9	32.1	16	29.6

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