HHS Public Access
Author manuscript
Retina. Author manuscript; available in PMC 2019 July 01.

Published in final edited form as:
Retina. 2018 July ; 38(7): 1393–1402. doi:10.1097/IAE.0000000000001725.

Retinal Detachment Surgery in a Pediatric Population: Visual and Anatomic Outcomes

Sarah P. Read, MD, PhD[1], **Hassan A. Aziz, MD**[1], **Ajay Kuriyan, MD**[1], **Nikisha Kothari, MD**[1], **Janet L. Davis, MD**[1], **William E. Smiddy, MD**[1], **Harry W. Flynn Jr, MD**[1], **Timothy G. Murray, MD**[2], and **Audina Berrocal, MD**[1]

[1]Department of Ophthalmology, Bascom Palmer Eye Institute, University of Miami Miller School of Medicine, Miami, FL, USA

[2]Murray Ocular Oncology and Retina, Miami, FL, USA

Abstract

Purpose—Pediatric retinal detachments (RD) are unique in etiology, anatomy, and prognosis compared to the adult population. Mechanisms of pediatric RD include tractional (TRD), rhegmatogenous (RRD), traumatic, and other types, such as exudative or hemorrhagic. This study examined visual and anatomic outcomes of pediatric RD undergoing surgical repair at a single university referral center.

Methods—A retrospective consecutive case series of patients clinically diagnosed and undergoing surgery for RD between birth and 15 years of age from 2002 to 2013 at single academic institution.

Results—A total of 206 patients (231 eyes) were included in this study of which 25 (12%) had bilateral RD. Of those patients, 67 (29%) had TRD (retinopathy of prematurity [ROP], persistent fetal vasculature [PFV], or familial exudative vitreoretinopathy [FEVR]), 51 (22%) had RRD (myopia, X-linked retinoschisis [XLRS], or Stickler syndrome), 60 (26%) had traumatic RD, and 53 (23%) were due to other types of RD, such as Coats' disease or coloboma. Presenting best corrected visual acuity (BCVA) better than 20/200 correlated with better final BCVA ($p<0.0001$). Anatomical success was strongly correlated with visual acuity outcome ($p<0.00001$) and was significantly more likely in RRD versus TRD (78% vs. 39%, $p<0.05$). The rates of obtaining a final BCVA > 20/200 were poorer in TRD (10%) compared to RRD (39%, $p<0.01$) or traumatic RD (28%, $p<0.05$).

Conclusions—Visual and anatomic outcomes varied among categories of RD. RRDs were associated with the best outcomes (anatomic success and globe conservation), whereas TRDs generally had poorer visual and anatomic outcome.

Corresponding Author: Sarah Read, MD, 900 NW 17th Street, Miami, Florida, USA, Telephone: (305) 326-6324, Fax: (305) 547-3675, read@med.miami.edu.

This data was presented at Annual Meeting of the Association for Research in Vision and Ophthalmology in 2015.

Financial Disclosure:
The authors have no proprietary or commercial interest in any materials discussed in this article.

SPR: none; HAA: none; AK: none; NK: none; JLD: none; WES: none; HWF: none; TGM: Alcon; AB: Alcon

Keywords

Pediatric surgery; Retinal detachment; Retinal surgery

Introduction

Pediatric retinal detachment (RD) is an uncommon and complex occurrence, accounting for a small proportion (3–13%) of retinal detachments in the total population.[1–5] Compared to adults, pediatric RDs have higher rates of macula off detachment, proliferative vitreoretinopathy, chronic duration, and worse presenting visual acuity.[2,4,6] Often pediatric patients have predisposing conditions associated with RDs.[2,4,7] The varied and complex etiology of pediatric RDs creates a challenge for clinicians in planning surgical management and in predicting prognosis.[8]

The purpose of this study was to report the visual and anatomic outcomes of pediatric RD surgery from a single institution.

Methods

The study was a retrospective, consecutive case series. All pediatric patients aged 15 years old and younger who underwent surgery for RD at the Bascom Palmer Eye Institute (BPEI) from 2002–2013 were included. This age range was selected as these patients have previously been shown to exhibit more complex forms of retinal detachment.[2] This analysis was performed with the approval of the Human Subject Research Office and Institutional Review Board at the Miami Miller School of Medicine. Patients were excluded from the study if they had previous surgery at another facility, history of retinoblastoma, follow up less than 3 months, incomplete clinical records, or inoperable RD. A diagnosis of an inoperable detachment was made at the discretion of the attending surgeon as one with a high chance of vision loss following the procedure or an eye without visual potential.

Presenting characteristics including age, sex, etiology of the detachment, macular status, description of break(s), and other accompanying examination characteristics were recorded. Cases were divided into groups according to the type of detachment: traumatic (open and closed globe), rhegmatogenous (myopia, Stickler's syndrome, X-linked juvenile retinoschisis [XLRS]), tractional (retinopathy of prematurity [ROP], persistent fetal vasculature [PFV], and familial exudative vitreoretinopathy [FEVR]) RDs, and other forms (Coats' disease, coloboma). Retinal detachments occurring in patients with ROP later in life were included as RRDs. In cases where more than one mechanism was identified (i.e. combined traction and RRD), the authors assigned the category based on what was felt to be the primary etiology of the detachment.

Surgical procedures performed included pars plana vitrectomy (PPV), scleral buckle (SB), and tamponade. The number of operations was recorded. The individual surgeon determined surgical approach based on clinical and anatomical features. Surgeries were performed at a single facility and multiple surgeons were involved. Outcome measures included best corrected visual acuity (BCVA), anatomic success, globe conservation, band keratopathy, and phakic status. Anatomic success was defined as sustained complete retinal attachment at the last examination. BCVA was measured using a Snellen chart or Teller cards unless the patient was too young or could not cooperate with testing.

Differences in qualitative or binary outcomes were analyzed using Chi-squared test with Fisher's exact test. Multiple groups were compared with Newman-Keuls post-hoc analysis. Initial and final visual acuity were compared using a paired Student *t*- Test. A p-value of $p<0.05$ was considered statistically significant. The statistical analysis was performed using the statistical software Prism V5.0a (GraphPad Software, Inc., La Jolla, CA, USA).

Results

Epidemiological Data

This study consisted of 206 patients, including 25 (12%) who had bilateral retinal detachment (RD) for a total of 231 eyes. There were 153 (74%) males. The left eye was involved in 114 eyes (49.4%), right in 117 eyes (50.6%). The average age at diagnosis at the BPEI was 7.3 years old (range 1 month to 15 years, median age 8.6) and the average time of postoperative follow-up was 48 months (range 3 months to 12.9 years). Mean follow up was shorter in traumatic RD (36.2 months ± 37.5) compared to TRD (56.7 months ± 42.8) and RRD (54.8 months ± 37.4).

Retinal Pathology

The underlying disease was recorded and 178 cases (77%) were further grouped according to larger etiologic subgroups while 53 eyes (23%) could not be clearly assigned a subgroup (Table 1). Eyes were divided into traumatic RDs (26%), tractional retinal detachments (TRDs, 29%,) non-traumatic rhegmatogenous RDs (RRDs, 22%), and other causes. Cases were grouped as "other" if there were not enough of the cases for analysis or the detachment could not be classified into one of the groups and included detachments associated with Coats disease (7 eyes), coloboma (6 eyes), uveitis (5 eyes), sickle cell (2 eyes), shaken baby syndrome (2 eyes) and one eye each with choroidal osteoma, morning glory disk, or optic pit. Additionally, 28 eyes had an unknown cause for their detachment; these were often chronic detachments with chronic PVR changes.

Analysis of the three groups disclosed that TRDs (3.3 years ± 3.3) presented at an earlier age ($p<0.05$) than those with traumatic RDs (9.7 years ± 3.9) or RRD (9.2 years ± 4.3) (Table 1). Patients with TRDs had a longer interval from presentation to surgical repair (Table 2), probably due to the inclusion of patients with potentially more chronic detachments, which tended to have longer intervals from diagnosis to surgery. There was no significant difference in the number of surgeries between types of detachment.

RRDs and traumatic RDs showed a similar pattern of retinal pathology (Table 3). No causative hole or tear was identified 42% of traumatic RDs. TRDs had the highest rate of PVR and recurrence. Of eyes with Coats disease, all retinal detachments were due to exudation. In eyes with coloboma, all were noted to have PVR and in all no causative break was identified.

Visual Acuity Outcomes

Patients with a presenting BCVA >20/200 had a significantly higher chance of final BCVA, >20/200 (p<0.0001) (Table 4). The rate of last BCVA better than 20/200 was lower in TRD compared to RRD (p<0.0005) or traumatic RD (p<0.05). Incidence of final BCVA better than 20/200 occurred most commonly with closed globe traumatic RD (46%) and least commonly with TRDs (10%). While visual improvements after surgery were modest, there was a significant trend towards improvement in final BCVA versus initial BCVA (Supplemental Figure 1), with mean LogMAR improving from 1.76 initial BCVA to 1.61 final BCVA (p<0.05 paired *t*-test).

Surgical Intervention

Pars plana vitrectomy (PPV) +/− scleral buckle (SB) with some form of tamponade was performed in 84% of eyes (Table 5). While 37 (16%) eyes underwent SB only, SB was combined with the PPV in 57% of cases. The agent used to tamponade the retina was gas in 39% and silicone oil in 45%. SB (alone or combined with PPV) was much more common in traumatic RD or RRD compared to tractional RD (p<0.0001).

Anatomical and Functional Outcome

Anatomic success was more likely in RRD and traumatic RD versus TRD (p<0.01) and globe conservation was higher in patients with RRD compared to traumatic RD or TRD (p<0.05, Table 6). RRD eyes had the highest rate of anatomical success (78%) and globe conservation (86%); globe conservation was achieved in 78% of myopia-associated cases and 100% of XLRS-associated RRD cases. TRD cases had the lowest rate of anatomical success (39%) and globe conservation (69%); the ROP portion of this subgroup had the lowest anatomic success rate (33%). Anatomical success was strongly correlated with BCVA outcome (OR 103.8, p<0.00001) - only one patient achieved BCVA better than 20/200 without anatomical success (0.4%). Globe conservation was significantly correlated with anatomic success (p<0.0001). There were 33 cases in which globe conservation occurred in the absence of anatomic success: 1/32 (3%) open globe, 6/28 (28%) closed globe, 15/39 (38%) ROP, 4/10 (40%) FEVR, 2/18 (11%) PFV, 3/32 (9%) myopia, 2/10 (20%) Stickler's, and no cases of XLRS.

Outcomes from surgical procedure

In the presence of pre-operative PVR, scleral buckle alone was rarely performed (3%) compared to PPV (34%) or SB/PPV (63%). This may partially explain why the SB only subgroup had lower rates of recurrence and better anatomical success (Table 7). Concurrent cataract extraction was performed in 63% of PPV without SB, and in 37% PPV with SB.

Discussion

This study is one of the largest reviews on surgical outcomes in pediatric retinal detachments and is unique in comparing different predisposing factors and correlating them with intervention and outcome. While grouping this data allows for the comparison of different detachment groups and may help to clarify overarching outcomes, it should be noted that the subgroups are not interchangeable and can have unique characteristics. In subgroups with possible combined etiology, for examine combined RRD and TRD, an effort was made to categorize the patient by the predominant mechanism. Grouping the etiologies is inherently subjective, and though some conclusions can be made, care should be taken in interpreting the results.

The current study had an overall lower anatomical success (62%) compared to other studies (72–80%),[2] possibly related to inclusion of TRD and a younger patient population. In children, the high rate of conditions that cause TRD and the high rate of PVR are thought to contribute to the lower success rates for pediatric RD compared to the adult population. Though the conditions in the current study paralleled those found commonly in other studies, such as ROP, FEVR, and Sticklers, the current study was focused more on a younger population leading to a higher proportion of TRDs. As in previously published studies, surgical intervention in the current study varied widely (Table 8). Table 8 includes trauma, TRD and RRD cases from the current study.

Anatomical success was significantly more likely in RRD and trauma versus TRD and globe conservation was significantly higher in patients with RRD compared to traumatic or TRD. As previously mentioned, Wang *et al*[2] included a majority of patients from ages 16–18, however the anatomic success rates in their subgroup of patients age 0–10 years was 52%, similar to our study.[2] In the current study the lowest rate of anatomical success was seen in patients with ROP (33%) or FEVR (40%). These results are similar to those found in the ETROP study, nine month anatomical success rate was 30% for eyes that underwent PPV with or without SB (56 eyes), and 60% for eyes that underwent SB alone (10 eyes),[9] with a third of patients having attachment at 6 years.[10] Other studies have found high rates of anatomic success up to 43–82% in ROP[11] and 84% in FEVR.[12] This may reflect differences in follow up duration, for example in the ROP study follow up ranged from 1 day to 20 years,[11] whereas in our study patients were followed for a minimum of 3 months. In our study second surgeries usually weren't performed until a mean of 296 days after the initial procedure, and thus some anatomic failures may be missed by short follow up windows. The authors note that variable follow up times could introduce a reporting bias into the data.[11] Differences in the severity of the detachment, reflected in higher rates of phthisis and in cases requiring PPV in our study, may also account for the differences in anatomical success.[11,12] Especially in the setting of tractional detachments, there may be differences in what defines a successful retinal attachment, which in our study was defined as complete retinal attachment at last follow up. Lastly, patient population risk factors that are as yet unknown may play a role.

Looking at all RD causes, anatomical success was strongly correlated with VA outcome. Best correct visual acuity (BCVA) outcomes in the current study were worse in TRD compared to RRD or traumatic RD, possibly due to the increased pathogenic complexity of TRD. Importantly, patients with TRD had a younger age of presentation (2.0 years old) compared to RRD (9.2 years old) and trauma (9.7 years old). In one study, age was shown to be a negative prognostic factor in final BCVA,[7] possibly due to association with PVR[3] and structural abnormalities.[2] Amblyopia is known major factor limiting outcomes in this age group, though its incidence was not reliably documented for inclusion in this study.

Globe conservation was found to correlate significantly with anatomical success, but was found to occur in the absence of anatomic success in 33/178 cases (18.5%), more frequently in patients with ROP (15/39, 38%) or FEVR (4/10, 40%). Anatomic success was defined by complete retinal attachment at last follow up. In patients with tractional RD, areas of retina may have remained stable but partially detached, allowing for globe conservation in the absence of complete retinal attachment in patients with ROP or FEVR.

SB alone was an effective procedure with a success rate of 70–80% in the pre-vitrectomy era, though it is likely that some complex cases were excluded, being deemed inoperable.[6,13] In the current study, use of SB alone was reserved for the mildest cases, and when used it was usually combined with PPV. SB alone or in combination was most common in traumatic retinal detachment (RD) and least common in tractional retinal detachment (TRD). In a large study by Wang *et al.* that included a small proportion of TRD cases, SB alone was performed as the primary intervention in 76% of patients (Table 8).[2] Over half of their patients were ages 16–18, an older age group not included in our study, and presented with a higher percentage of RRD, perhaps making these detachments more amenable to primary scleral buckle. The 16–18 year old age group tended to have better visual acuity (VA) outcomes and lower rates of recurrence compared to younger patients. Gonzalez *et al*[7] studied pediatric detachments in 46 cases, finding that only 26% underwent primary scleral buckle alone whereas PPV with or without SB was performed in 74% with 88% of PPV cases using silicone oil as tamponade.

Trauma is one of the most common causes of pediatric RD; reported incidences range from 21–to 53% (Table 8).[2,3,6] In the current study only 13.9% of RRD cases were attributed to myopia. Studies from Taiwan[2,14,15] report higher rates of myopic detachment, likely due to the overall higher rate of myopia in Taiwan. A review from the United States reported a similar incidence of myopia causing pediatric RRD (~17%).[7] In other studies, TRD makes up a much smaller proportion, which may partially explain some of the differences in reported outcomes as TRD made up a larger proportion in our study compared to others.

Proliferative vitreoretinopathy (PVR) occurs more commonly in pediatric cases possibly due to chronicity of the detachment with a higher level of inflammation and cellular proliferation,[4] and has been reported to occur between 20–60% of cases (Table 8).[2,3,6,16] The incidence of PVR in the current study was 71% and was even higher in TRD (82% PVR) which also had the highest RD recurrence rate (69%). Previous reports have shown PVR to be higher in open versus closed globe trauma,[17] although in our study open and closed globe injuries had similar incidences of PVR, 56% and 54%, respectively. However, in the current study there was a higher incidence of recurrence of retinal detachment in open globe (72%) versus closed globe (50%) injuries.

The current study was limited by its retrospective nature, lack of long term follow up in some patients, and missing or incomplete records- specifically refraction and documented condition of the fellow eye. The loss to follow up was often a byproduct of the tertiary nature of pediatric RDs coming from more distant locales and is especially problematic in that long-term sequelae of repair as well as involvement of the contralateral eye could often not be assessed. Given the variable follow up, visual acuity outcome was based off of final patient visit, which limits the accuracy of comparisons. Also, measuring accurate VA in children can prove challenging especially in the setting of amblyopia and aphakia.

The current study is one of the largest series of pediatric RD. ROP and trauma were the most common etiologies. Overall we found that there was only modest improvement in vision with surgical intervention and that initial visual acuity was predictive of final acuity. This study is additionally unique in that we sought to compare different etiological factors, namely trauma, traction, and non-traumatic rhegmatogenous, and correlate them with presentation and prognosis. It is important to consider that confounding factors, such as age or presenting visual acuity, limit this comparison.

Outcomes in pediatric RD depend on the specific cause of RD, presenting BCVA, presence of PVR, patient age, and incidence of amblyopia. Although good visual outcome without anatomic success is rare, anatomic success may not predict visual outcome. Recognizing that TRD carries the lowest rate of positive visual outcome while non-traumatic RRDs have the best outcomes (anatomic success and globe conservation) allows for a better understanding of prognosis and more realistic counseling of patients and their families regarding expectations and outcomes.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Financial Support:

NIH Center Core Grant P30EY014801, an unrestricted grant to the University of Miami from National Eye Institute and Research to Prevent Blindness, New York, New York, USA.

Department of Defense: DOD- Grant #W81XWH-13-1-0048, an unrestricted grant to the University of Miami.

References

1. Haimann MH, Burton TC, Brown CK. Epidemiology of retinal detachment. Archives of ophthalmology. 1982; 100:289–92. [PubMed: 7065947]
2. Wang NK, Tsai CH, Chen YP, et al. Pediatric rhegmatogenous retinal detachment in East Asians. Ophthalmology. 2005; 112:1890–5. [PubMed: 16271317]
3. Soheilian M, Ramezani A, Malihi M, et al. Clinical features and surgical outcomes of pediatric rhegmatogenous retinal detachment. Retina. 2009; 29:545–51. [PubMed: 19174726]
4. Soliman MM, Macky TA. Pediatric rhegmatogenous retinal detachment. International ophthalmology clinics. 2011; 51:147–71. [PubMed: 21139482]
5. Van de Put MA, Hooymans JM, Los LI, Dutch Rhegmatogenous Retinal Detachment Study G. The incidence of rhegmatogenous retinal detachment in The Netherlands. Ophthalmology. 2013; 120:616–22. [PubMed: 23218185]
6. Wenick AS, Baranano DE. Evaluation and management of pediatric rhegmatogenous retinal detachment. Saudi journal of ophthalmology: official journal of the Saudi Ophthalmological Society. 2012; 26:255–63. [PubMed: 23961003]
7. Gonzales CR, Singh S, Yu F, Kreiger AE, Gupta A, Schwartz SD. Pediatric rhegmatogenous retinal detachment: clinical features and surgical outcomes. Retina. 2008; 28:847–52. [PubMed: 18536601]

8. Rahimi M, Bagheri M, Nowroozzadeh MH. Characteristics and outcomes of pediatric retinal detachment surgery at a tertiary referral center. Journal of ophthalmic & vision research. 2014; 9:210–4. [PubMed: 25279123]

9. Repka MX, Tung B, Good WV, et al. Outcome of eyes developing retinal detachment during the Early Treatment for Retinopathy of Prematurity Study (ETROP). Archives of ophthalmology. 2006; 124:24–30. [PubMed: 16401781]

10. Repka MX, Tung B, Good WV, Capone A Jr, Shapiro MJ. Outcome of eyes developing retinal detachment during the Early Treatment for Retinopathy of Prematurity study. Archives of ophthalmology. 2011; 129:1175–9. [PubMed: 21911664]

11. Nudleman E, Robinson J, Rao P, Drenser KA, Capone A, Trese MT. Long-term outcomes on lens clarity after lens-sparing vitrectomy for retinopathy of prematurity. Ophthalmology. 2015; 122:755–9. [PubMed: 25600197]

12. Yamane T, Yokoi T, Nakayama Y, Nishina S, Azuma N. Surgical outcomes of progressive tractional retinal detachment associated with familial exudative vitreoretinopathy. American journal of ophthalmology. 2014; 158:1049–55. [PubMed: 25127701]

13. Errera MH, Liyanage SE, Moya R, Wong SC, Ezra E. Primary Scleral Buckling for Pediatric Rhegmatogenous Retinal Detachment. Retina. 2015; 35:1441–9. [PubMed: 25741811]

14. Chang PY, Yang CM, Yang CH, et al. Clinical characteristics and surgical outcomes of pediatric rhegmatogenous retinal detachment in Taiwan. American journal of ophthalmology. 2005; 139:1067–72. [PubMed: 15953438]

15. Chen SN, Jiunn-Feng H, Te-Cheng Y. Pediatric rhegmatogenous retinal detachment in taiwan. Retina. 2006; 26:410–4. [PubMed: 16603959]

16. Fivgas GD, Capone A Jr. Pediatric rhegmatogenous retinal detachment. Retina. 2001; 21:101–6. [PubMed: 11321134]

17. Sarrazin L, Averbukh E, Halpert M, Hemo I, Rumelt S. Traumatic pediatric retinal detachment: a comparison between open and closed globe injuries. American journal of ophthalmology. 2004; 137:1042–9. [PubMed: 15183788]

Summary Statement

The current study is one of the largest to examine the surgical intervention and outcomes of pediatric traumatic, rhegmatogenous, and tractional detachments. Overall, outcomes were best in rhegmatogenous and worst in tractional detachments.

Table 1

Patient characteristics of retinal detachment in a pediatric referral practice

Etiology		Number of Eyes		Age at diagnosis
Traumatic RD	Open Globe	32	13.9%	10.0
	Closed Globe	28	12.1%	9.6
TRD	ROP	39	16.8%	4.3
	FEVR	10	4.3%	4.8
	PFV	18	7.8%	0.5
RRD	Myopia	32	13.9%	10.5
	XLRS	9	3.9%	3.8
	Stickler’s Syndrome	10	4.3%	10.0
Other	Coats’	7	3.0%	6.9
	Coloboma	6	2.6%	9.5
	Other/Unknown	40	17.3%	–

FEVR: familial exudative vitreoretinopathy; PFV: persistent fetal vasculature; ROP: retinopathy of prematurity; RRD: rhegmatogenous retinal detachment; TRD: tractional retinal detachment; XLRS: X-linked retinoschesis

Table 2

Epidemiology of retinal detachments in a pediatric referral practice. Mean (standard deviation)

Etiology	Eyes	Time to surgery (days)	Number of surgeries
Trauma	60	10.1 (15.7)	1.8 (0.9)
Open	32	12.7 (19.7)	1.5
Closed	28	7.0 (8.6)	1.9
TRD	67	14.7 (20.7)	1.5 (0.78)
ROP	39	10.2 (18.3)	1.4
FEVR	10	21.7 (22.8)	1.5
PFV	18	21.5 (23.1)	1.9
RRD	51	10.0 (17.6)	1.8 (0.9)
Myopia	32	7.7 (13.5)	1.7
XLRS	9	11.2 (12.4)	2.0
Stickler’s	10	15.7 (28.9)	2.1
Other	53	27.2 (37.2)	1.7 (0.1)

FEVR: familial exudative vitreoretinopathy; PFV: persistent fetal vasculature; ROP: retinopathy of prematurity; RRD: rhegmatogenous retinal detachment; TRD: tractional retinal detachment; XLRS: X-linked retinoschesis

Table 3

Retinal pathology in pediatric patients with retinal detachment

Etiology	Retinal Pathology	PVR	Recurrence	Patients >1 Surgery
Trauma, n=60	Undetected: 42% Giant Retinal Tear: 27% Retinal Tear: 22% Dialysis: 10%	55%	62%	43%
Open	Undetected: 50% Giant Retinal Tear: 28% Retinal Tear: 16% Dialysis: 6%	56.2%	71.9%	31.2%
Closed	Undetected: 32% Giant Retinal Tear: 25% Retinal Tear: 27% Dialysis: 14%	53.6%	50.0%	57.1%
RRD, n=51	Retinal Hole: 31% Retinal Tear: 25% Giant Retinal Tear: 25% Dialysis: 6% Undetected: 12%	69%	59%	53%
Myopia	Retinal Hole: 31% Retinal Tear: 16% Giant Retinal Tear: 28% Dialysis: 6% Undetected: 20%	62.5%	53.1%	43.8%
XLRS	Retinal Hole: 22% Retinal Tear: 20% Giant Retinal Tear: 22% Dialysis: 1% Undetected: 0%	100%	55.6 %	77.8%
Stickler’s	Retinal Hole: 40% Retinal Tear: 40% Giant Retinal Tear: 20% Dialysis: 0% Undetected: 0%	60%	80%	60%
TRD, n=67	Traction 100%	82%	69%	39%
ROP	Traction 100%	76.9%	69.2%	38.5%
FEVR	Traction 100%	88.9%	55.6%	22.2%
PFV	Traction 100%	90%	90%	70%
Other, n=53	Undetected: 32% Exudative: 23% Traction: 17% Retinal tear: 9% Retinal hole: 9% Dialysis: 6% Giant retinal tear: 4%	75%	62%	49%

FEVR: familial exudative vitreoretinopathy; PFV: persistent fetal vasculature; ROP: retinopathy of prematurity; RRD: rhegmatogenous retinal detachment; TRD: tractional retinal detachment; XLRS: X-linked retinoschesis

Table 4

Visual acuity outcomes in pediatric patients with retinal detachment

Etiology	Initial Visual Acuity		Last Visual Acuity	
	>20/200	≤20/200	>20/200	≤20/200
Trauma (60)	13/60 (22%)	47/60 (78%)	17/60 (28%)	43/60 (72%)
Open	1/32 (3%)	31/32 (97%)	4/32 (13%)	28/32 (88%)
Closed	12/28 (43%)	16/28 (57%)	13/28 (46%)	15/28 (54%)
RRD (51)	16/51 (31%)	35/51 (69%)	20/51 (39%)	31/51 (61%)
Myopia	11/32 (34%)	21/32 (66%)	13/32 (41%)	19/32 (59%)
XLRS	1/9 (11%)	8/9 (89%)	4/9 (44%)	5/9 (56%)
Stickler’s	4/10 (40%)	6/10 (60%)	3/10 (30%)	7/10 (70%)
TRD (67)	6/67 (9%)	61/67 (91%)	7/67 (10%)	60/67 (90%)
ROP	3/39 (8%)	36/39 (92%)	4/39 (10%)	35/39 (90%)
PFV	0/18 (0%)	18/18 (100%)	2/18 (11%)	16/18 (89%)
FEVR	3/10 (30%)	7/10 (70%)	1/10 (10%)	9/10 (90%)
Other (53)	11 (21%)	42 (79%)	17 (32%)	36 (68%)

FEVR: familial exudative vitreoretinopathy; PFV: persistent fetal vasculature; ROP: retinopathy of prematurity; RRD: rhegmatogenous retinal detachment; TRD: tractional retinal detachment; XLRS: X-linked retinoschesis

Table 5

Surgical intervention in pediatric patients with retinal detachment

Etiology	SB	PPV/gas	PPV/oil	SB/PPV/gas	SB/PPV/oil
Trauma (60)	5 (8%)	6 (10%)	5 (8%)	16 (27%)	28 (47%)
Open (32)	0%	12.5%	9.3%	12.5%	59.4%
Closed (28)	18%	7.1%	7.1%	35.7%	32.1%
TRD (67)	13 (19%)	31 (46%)	5 (7%)	6 (9%)	12 (18%)
ROP	30.9%	41.0%	5.1%	5.1%	17.9%
FEVR	0%	20%	20%	20%	40%
PFV	5.6%	72.2%	5.6%	11%	5.6%
RRD (51)	9 (18%)	2 (4%)	2 (4%)	16 (31%)	22 (43%)
Myopia	15.6%	3.1%	3.1%	31.3%	46.9%
XLRS	0%	11.1%	11.1%	27.4%	46.9%
Stickler's	40%	0%	0%	30%	30%
Other (53)	10 (19%)	6 (11%)	5 (9%)	8 (15%)	24 (45%)
Total	37 (16%)	45 (19%)	17 (7%)	46 (20%)	86 (37%)

FEVR: familial exudative vitreoretinopathy; PFV: persistent fetal vasculature; PPV: pars plana vitrectomy; ROP: retinopathy of prematurity; RRD: rhegmatogenous retinal detachment; SB: scleral buckle; TRD: tractional retinal detachment; XLRS: X-linked retinoschesis

Table 6

Anatomic outcomes of retinal detachment surgery in pediatric patients

Etiology		AS	Globe Conservation	Phakic Status	BK
Trauma	Open (n=32)	50%	Yes (22, 68.8 %) No: (10, 31.2 %) Enucleation (3, 30%) Phthisical (7, 70%)	Phakic (1, 3.5%) Pseudophakic (3, 10.3%) Aphakic (25, 86.2%)	55.2%
	Closed (n=28)	82.1%	Yes (24, 85.7%) No: (4, 14.3%) Enucleation (0, 0 %) Phthisical (4, 100 %)	Phakic (11, 39.3 %) Pseudophakic (9, 32.1 %) Aphakic (8, 28.6%)	17.9%
	Total	65%	Yes: 77% No: 23% Enucleation: 21% Phthisical: 79%	Phakic: 21% Pseudophakic: 21% Aphakic: 58%	37%
TRD	FEVR (n=10)	40%	Yes (8, 80%) No: (2, 20%) Enucleation (0, 0%) Phthisical (2, 100%)	Phakic (5, 50 %) Pseudophakic (0, 0%) Aphakic (5, 50%)	50%
	PFV (n=18)	50%	Yes (11, 61.1%) No: (7, 38.9%) Enucleation (4, 57.1%) Phthisical (3, 42.9%)	Phakic (1, 7.1%) Pseudophakic (0, %) Aphakic (13, 92.9%)	28.6%
	ROP (n=39)	33.3%	Yes (27, 69.2%) No: (12, 30.8%) Enucleation (0, 0%) Phthisical (12, 100%)	Phakic (20, 51.3%) Pseudophakic (2, 5.1%) Aphakic (17, 43.6%)	69.2%
	Total	39%	Yes: 69% No: 31% Enucleation: 19% Phthisical: 81%	Phakic: 41% Pseudophakic: 3% Aphakic: 56%	41%
RRD	Myopia (n=32)	78.1%	Yes (27,84.4 %) No: (5, 15.6%) Enucleation (1, 20%) Phthisical (4, 80%)	Phakic (9, 29.0%) Pseudophakic (8, 25.8%) Aphakic (14, 45.2%)	35.5%
	XLRS (n=9)	100%	Yes (9, 100%) No: (0, 0%) Enucleation (0, 0%) Phthisical (0, 0%)	Phakic (2, 22.2%) Pseudophakic (3, 33.3%) Aphakic (4, 44.4%)	11.1%
	Stickler’s Sydnrome (n=10)	60%	Yes (8, 80%) No: (2, 20%) Enucleation (1, 50%) Phthisical (1, 50%)	Phakic (2, 22.2%) Pseudophakic (6, 66.7%) Aphakic (1, 11.1%)	11.1%
	Total	78%	Yes: 86%	Phakic: 27%	27%

Etiology		AS	Globe Conservation	Phakic Status	BK
			No: 14% Enucleation: 29% Phthisical: 71%	Pseudophakic: 35% Aphakic: 39%	
Other	Coats' (n=7)	86%	Yes: 86% No: 14% - Enucleation: 0% - Phthisical: 100%	Phakic: 29% Pseudophakic: 71% Aphakic: 0%	29%
	Coloboma (n=6)	50%	Yes: 67% No: 33% - Enucleation: 0% - Phthisical: 100%	Phakic: 33% Pseudophakic: 17% Aphakic: 50%	33%
	Misc (n=12)	67%	Yes: 75% No: 25% - Enucleation: 33% - Phthisical: 67%	Phakic: 25% Pseudophakic: 33% Aphakic: 42%	27%
	Unknown (n=28)	79%	Yes: 82% No: 18% - Enucleation: 0% - Phthisical: 100%	Phakic: 43% Pseudophakic: 32% Aphakic: 25%	21%
	Total	74%	Yes: 79% No: 21% - Enucleation: 9% - Phthisical: 91%	Phakic: 36% Pseudophakic: 36% Aphakic: 28%	25%
All RD	Total	62%	Yes: 77% No: 23%	Phakic: 32% Pseudophakic: 22% Aphakic: 46%	33%

AS: anatomic success; BK band keratopathy; FEVR: familial exudative vitreoretinopathy; PFV: persistent fetal vasculature; ROP: retinopathy of prematurity; RRD: rhegmatogenous retinal detachment; TRD: tractional retinal detachment; XLRS: X-linked retinoschesis

Table 7

Surgical intervention and outcome in TRD, RRD, and traumatic RD

Surgical Intervention	Pre-operative PVR	Cataract Extraction	Recurrence	Anatomical Success	BK
SB only	4/27 (15%)	0/27 (0%)	5/27 (19%)	25/27 (93%)	1/27 (4%)
PPV +/− gas/oil	41/51 (80%)	32/51 (63%)	37/51 (73%)	21/51 (41%)	14/48 (30%)
SB/PPV +/−gas/oil	75/100 (75%)	37/100 (37%)	70/100 (70%)	59/100 (59%)	39/96 (41%)

BK: band keratopathy; PPV: pars plana vitrectomy; PVR: proliferative vitreoretinopathy; SB: scleral buckle

Table 8

Comparison with other studies of pediatric retinal detachment repairs.

Study	# of eyes (included age)	Mean age	Trauma	RRD	TRD	PVR	Primary Surgical intervention	Final VA	Recurrence
Current study	178 (0–15)	7.4	33%	29%	38%	68%	SB: 15% PPV: 29% SB/PPV: 56%	25% (>20/200)	63%
Weinberg 2003[17]	39 (0–18)	10	36%	41%	23%	31%	SB: 41% PPV: 13% SB/PPV: 46%	15% (≥20/200)	n/a
Sarrazin 2004[14]	60 (0–18)	11.6	100%	0%	0%	3%	n/a	28% (>20/200)	45%
Chang 2005[11]	152 (0–18)	13.1	33%	40%	7%	18.4%	SB: 62.1% PPV: 38.8%	n/a	30%
Wang 2005[2]	145 (0–15) 151 (16–18)	14.6	37.1%	46.8%	3.6%	45.6%	SB: 75.7% PPV: 5.4% SB/PPV: 18.9%	39% age 0–15; 64% age 16–18 (VA≥20/100)	39% 0–15, 17% 16–18
Wadhwa 2008[18]	230 (0–18)	11.1	34%	66%	n/a	44.8%	SB: 31% PPV: 63%	60% (≥4/200)	54%
Gonzalez 2008[7]	46 (0–18)	9.8	43%	57%	0%	59%	SB: 26% PPV: 44% SB/PPV: 30%	44% (≥20/200)	88%
Soheilian 2009[3]	127 (0–18)	12.1	44.3%	24.4%	1.6%	45%	SB:31% SB/PPV: 63%	37% (≥20/200)	10%
Oono 2012[19]	48 (0–15)	12.3	38%	25%	8.3%	15%	SB: 77% PPV: 23%	85% (≥20/200)	17%
Al-Zaaidi 2013[20]	166 (0–16)	8.3	43%	51%	6%	33%	SB: 12% PPV: 16% SB/PPV: 68%	44% (≥20/200)	36%

PPV: pars plana vitrectomy; PVR: proliferative vitreoretinopathy; RRD: rhegmatogenous retinal detachment; SB: scleral buckle; TRD: tractional retinal detachment; VA: visual acuity