

Bilateral Vitreous Hemorrhage in Children: Clinical Features and Outcomes

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Abstract

Purpose: To determine the etiology, clinical features and outcomes of bilateral vitreous hemorrhage (VH) in children.

Methods: This retrospective chart review was performed on patients with bilateral VH under the age of 18 at a tertiary eye care center in India. Data included demographics, details of history and ocular examination, reports of investigations, surgeries or other interventions performed, and final anatomical and visual outcomes. Patients were divided into two groups i.e., traumatic and non-traumatic (spontaneous).

Results: The traumatic group was comprised of 37 patients including 27 male and 10 female subjects with mean age of 13.47 ± 5.31 years, the most common complaint was decreased vision (96.45%) and the most prevalent etiology was firecracker injury in 16 (43.2%) patients. Mean baseline visual acuity (VA) was 2.34 ± 1.31 logMAR which was significantly improved to 1.08 ± 0.23 logMAR ($P = 0.042$). The mean number of surgeries was 2.72 ± 1.43 in the traumatic VH and mean follow up period was 23.14 ± 6.54 months. The spontaneous group included 48 subjects comprised of 27 male and 21 female cases with mean age of 14.48 ± 2.03 years. The most common cause was vasculitis in 21 (43.75%) subjects including four patients with tuberculosis. Mean baseline VA was 1.97 ± 1.13 logMAR which showed a significant improvement to 0.82 ± 0.24 logMAR ($P = 0.012$) after mean follow up of 34.2 ± 11.2 months. Eleven patients required at least one major surgery.

Conclusion: Vasculitis was the most common cause of spontaneous bilateral VH; traumatic VH most prevalently occurred due to firecracker injury. Final VA was better in the spontaneous group.

Keywords: Bilateral; Firecracker Injuries; Pediatric; Spontaneous; Trauma; Vasculitis; Vitreous Hemorrhage

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INTRODUCTION

Blindness and visual impairment in children imposes a significant burden on the society. Bilateral vitreous

hemorrhage (VH) in children is a disabling entity which may result in decreased visual function, both due to media opacity and secondary to visual deprivation amblyopia. Moreover, VH obscures the posterior segment and if severe and non-traumatic, may lead to diagnostic dilemmas unless associated with classic systemic signs and symptoms.

Vasculitis, hematologic disorders and trauma are well established causes of bilateral VH in children.^[1,2] There

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is limited literature available on causes and outcomes of bilateral VH,^[3,4] more so in children. This entity is often overlooked in a more general analysis of the etiology and outcomes of pediatric VH including unilateral and bilateral VH in most series. A large portion of currently available literature comprises of case reports and series.^[5-13] Uncommon identified causes include pars planitis, clotting factor deficiency and hemorrhage secondary to a persistent hyaloid artery. The condition is important as bilateral VH leads to immediate visual loss, and if left untreated may affect the child's development.

Unilateral VH is often not immediately incapacitating and in many cases may not be noticed early. Furthermore, examination of the fellow eye may provide some clues as to the exact cause. While in traumatic cases, the cause is generally obvious; it may not be evident in non-traumatic cases, as well as non-accidental trauma.

The present study was conducted to determine the etiology and outcomes, both functional and anatomical, of bilateral vitreous hemorrhage in children.

METHODS

A retrospective computer assisted database search and chart review was carried out on all subjects with a diagnosis of vitreous hemorrhage aged under 18 who presented to LV Prasad Eye Institute, Kallam Anji Reddy Campus, Hyderabad, India, between January 2002 and May 2012. A total of 619 pediatric patients with a diagnosis of VH in our medical records department database were identified. Analysis, after exclusion of active retinopathy of prematurity (ROP) cases ($n = 34$ patients) and those with an incorrect diagnosis ($n = 27$ patients) or coding errors ($n = 13$), was performed on 548 subjects. Out of these 548 patients, 463 and 85 subjects had unilateral and bilateral VH, respectively and the latter group was analyzed for this particular study. Written informed consent had been obtained from all subjects' guardians. The institutional review board approved the study and all the procedures adhered to the tenets of the Declaration of Helsinki. The chart review followed the previously set out guidelines, described in earlier publications.^[14]

Data collected included demographics, presenting symptoms and signs, details of history, which were obtained from a cooperative child or if not, from the parents, details regarding the trauma including material and circumstances, presenting corrected distance visual acuity, details of the examination procedure, additional investigations and systemic examination, the cause (if evident), treatments performed, associated systemic injuries, duration of follow up, and final anatomical and visual outcomes. Special care was taken to look for non-accidental trauma by means of a detailed history and comprehensive ocular and systemic examinations. Visual acuity was measured using the early treatment

diabetic retinopathy study (ETDRS) chart and the results were subsequently converted to logMAR notations. For children in the age range of 6 months to 4 years, Teller acuity charts were used and similarly converted to logMAR units.

A comprehensive ocular examination was performed in all cases, under short general anesthesia if the child was not cooperative. If media clarity was insufficient to permit adequate fundus examination, or when additional information, such as choroidal thickness or orbital status was required, a B scan ultrasound examination was performed (OPKO OTI Pvt. Ltd. Miami, FL, USA). Trauma was classified based on the Pediatric Ocular Trauma Score.^[15] Patients had undergone complete systemic examination, supported with investigations, as appropriate. Ocular investigations included ultrasonography, optical coherence tomography (OCT) and fluorescein and indocyanine green angiography, wherever appropriate. Vitreous biopsy, when taken, was subjected to tests for microbial analysis such as polymerase chain reaction (PCR) testing as well as histopathological analysis. Systemic investigations included monitoring blood pressure, complete blood counts (CBC), erythrocyte sedimentation rate (ESR), C-reactive protein (CRP) testing as well tests for infective and autoimmune etiologies such as the Mantoux test, quantiferon TB test, serum angiotensin converting enzyme (ACE) levels, serum calcium levels and tests for auto antibodies such as antinuclear antibody (ANA) and rheumatoid factor (RF).

Surgical interventions ranged from diagnostic vitreous biopsies for PCR or antibody assays to combined anterior and posterior segment interventions. Non-surgical therapy consisted of observation, topical or systemic medical therapy and/or laser photocoagulation. Frequent cycloplegic refractions and amblyopia therapy by part time occlusion were part of the management protocol. Patients were divided into two groups, based on whether the etiology of vitreous hemorrhage was traumatic or non-traumatic (spontaneous).

Statistical analysis was performed using SPSS software (version 16.0; SPSS, Chicago, IL, USA), with special emphasis on the aforementioned information. *P* values less than 0.05 were considered as statistically significant.

RESULTS

Out of a total of 85 pediatric patients with a diagnosis of bilateral vitreous hemorrhage identified in our medical records department database, 48 (56.47%) and 37 (43.53%) subjects had non-traumatic (spontaneous) and traumatic VH, respectively. The approach to a patient with spontaneous VH has been outlined in one of our earlier publications.^[16] The characteristics of both groups are detailed in Table 1.

Table 1. Basic information of patients in the spontaneous and traumatic vitreous hemorrhage groups

Features	Spontaneous hemorrhage	Traumatic hemorrhage
Mean age (year)	14.48±2.03	13.47±5.31
Common causes (%)	Vasculitis (43.7) Hematological disorders* (37.5)	Firecracker injuries (43.2) Road traffic accidents (24.3)
Number of cases required surgical intervention (%)	27 (72.97)	15 (31.25)
Mean number of surgeries	1.24±0.97	2.72±1.43
Mean base line visual acuity (logMAR)	1.97±1.13	2.34±1.31
Mean final visual acuity (logMAR)	0.82±0.24	1.08±0.23
Mean time to presentation (range, days)	5.42±2.12 (1-28)	2.24±1.1 (1-16)
Mean follow-up from last intervention (month)	34.23±11.23	23.14±6.54
The most common complaints at presentation (%)	Decreased vision (98.54) Inability to perform usual tasks (84.24)	Diminished vision (96.45) Pain (92.34) Redness (91.45)

*Hematological disorders include leukemia, thrombocytopenia, and anemia

Bilateral Traumatic Vitreous Hemorrhage Group

This group was comprised of 37 subjects including 27 male and 10 female subjects. The bilateral VH was due to firecracker injury in 16 (43.24%) patients. The remaining patients had injury with sticks (14 eyes), stones (10 eyes) and in road traffic accidents (18 eyes). Meanwhile, 3 patients (6 eyes) had bilateral open globe injury and 6 patients had open globe injury in one eye and blunt injury in the other, of whom 2 patients had an intraocular foreign body in the eye with open globe injury; the rest had bilateral closed globe injuries. Among the firecracker injury group, only one patient had globe rupture in one eye; the rest had closed globe injuries. Mean baseline best corrected visual acuity (BCVA) in the traumatic group was 2.34 ± 1.31 logMAR (approximately counting fingers at 2 m) which was significantly improved to a mean final VA of 1.08 ± 0.23 logMAR (about 6/60, $P = 0.042$).

Ten eyes with open globe injury underwent primary repair; if bilateral, in the same session. Five of these eyes underwent additional vitreoretinal surgery for clearance of VH associated with retinal detachment after the primary repair within one month. Two of these ten eyes received vitrectomy two months later as the VH was non-clearing. Two eyes underwent foreign body removal. The mean number of surgeries in the traumatic VH group was 2.72 ± 1.43 . In our patients with closed globe injuries, the main indications for intervention included the presence of retinal detachment (16 eyes), raised intraocular pressure not responding to medical therapy (4 eyes), absence of ambulatory vision (1 patient), young children aged under 8 years in whom visual deprivation and subsequent amblyopia was a threat (1 patient), and bilateral dense VH (2 eyes) completely obscuring the fundus. In 3 patients, cataract removal with intraocular lens (IOL) implantation in the sulcus was performed for ruptured posterior capsule. Three patients required lensectomy and scleral fixated IOLs for subluxated/dislocated lens.

Six eyes required laser photocoagulation for retinal dialysis/breaks. Six eyes had inoperable retinal detachments. The remaining eyes (22) were either merely observed (8 eyes) or received topical and/or systemic medical therapy which included topical steroids with cycloplegics for control of traumatic uveitis (8 eyes), intraocular pressure (IOP) lowering agents along with topical steroids or cycloplegics for raised IOP and inflammation (4 eyes), or systemic steroids concurrent with ocular therapy for inflammation not responding to topical therapy (2 eyes). If both eyes required to be operated, the interval between surgeries was one month. Concurrent injuries, such as lid burns or lacerations (9 patients) were managed at the primary visit itself. Retinal re-detachment occurred in 2 and 3 patients in the open and closed globe injury sub-groups, respectively; one patient in the open globe injury sub-group refused further intervention. Others underwent successful retinal detachment repair and the retina remained attached until the last follow up visit. Mean follow up since last surgical intervention was 23.1 ± 6.5 months.

Bilateral Spontaneous Vitreous Hemorrhage Group

This group was comprised of 48 patients including 27 male and 21 female subjects; 21 cases had vasculitis, of whom four subjects had tuberculosis. The etiology could not be determined in the remaining patients despite extensive investigations. Eighteen patients had a hematological disorder including leukemia in 7 cases, anemia in 4 subjects, thrombocytopenia in 3 patients and sickle cell anemia in 4 cases. Diabetic retinopathy, familial exudative vitreoretinopathy (FEVR) and retinal breaks in both eyes were found in 4, 4 and one subjects, respectively.

In the present cohort, 11 patients (14 eyes) required major surgery; 3 had FEVR, required bilateral surgery within an interval ranging from one week to one month.

Six patients (including 4 cases with vasculitis) underwent vitrectomy with or without endolaser photocoagulation for dense vitreous hemorrhage in one eye, the other eye being observed. Two out of these six patients had leukemia and underwent diagnostic vitreous biopsy along with vitrectomy after the patients were systemically stable. Two patients were diabetic with a tractional detachment and vitreous hemorrhage, and required surgery only in one eye. One of them returned with a rhegmatogenous detachment under silicone oil that was re-operated, and was stable up to final follow-up. The mean number of surgeries in this group was 1.24 ± 0.97 . The patient with bilateral retinal breaks underwent laser photocoagulation. Two other patients with vasculitis only underwent a diagnostic vitreous biopsy which turned out negative for common causes such as tuberculosis, sarcoidosis, syphilis and human immunodeficiency virus as well as herpes simplex and zoster viruses and cytomegalovirus. Nine patients with vasculitis and 2 others with diabetic retinopathy underwent laser retinal photocoagulation. The remaining patients were treated systemically including oral steroids, hematinics and chemotherapy; and the hemorrhage resolved over time. Mean final VA was 0.82 ± 0.24 logMAR (20/125), showing a statistically significant improvement as compared to mean baseline VA (1.97 ± 1.13 logMAR) ($P = 0.012$). Mean follow up duration was 34.2 ± 11.2 months. Visual acuity was significantly better in the spontaneous hemorrhage group as compared to the traumatic group ($P = 0.022$). The odds that a patient would undergo surgery were higher in the traumatic group (OR = 8.23, 95% CI: 3.71-17.34).

None of the patients in either group developed endophthalmitis throughout the follow up period. Ultrasonographic findings in both groups have been described in Table 2.

DISCUSSION

The most common cause of bilateral vitreous hemorrhage in the Western literature appears to be non-accidental trauma or the battered baby syndrome^[2] followed

by anecdotal reports of various ocular and systemic conditions such as vasculitis^[1] or low platelet levels.^[17,18] This stands in contrast to our series wherein firecracker injuries emerged as the most common cause. Vitreous hemorrhage secondary to firecracker injuries has been reported earlier.^[19,20] Firecracker injuries in particular are concentrated around the Indian festival of Diwali (75.43%). We did not encounter any case of battered baby syndrome, although a high index of suspicion was maintained in all patients with bilateral hemorrhage. This particular finding agrees with another series from India, in which no patients with battered baby syndrome was found.^[1]

The same series by Rishi et al^[1] reported that bilateral VH was always spontaneous, contrary to the current study, in which 43.52% of the patients had some form of trauma. Firecracker injuries accounted for nearly 43% of traumatic bilateral VH and also one-fifth of all patients, making it probably the single most important cause of bilateral VH in our series. Thus the etiology is extremely varied, even within a particular region and further variation is possible when adults are taken into account.^[21] In addition, we did not find instances of VH secondary to galactosemia^[9] or a persistent hyaloid artery.^[10]

Indications for surgery were slightly different in view of the age group under study as well as bilaterality of the condition unlike pediatric vitreous hemorrhage in general, in which one might choose to intervene after a period of observation. Although in adults, one tends to intervene later, early intervention can be considered in children, given the threat of visual deprivation and impediment to vision and overall development of the child.

Vasculitis,^[1] hematological disorders^[1,5,7,13] and diabetic retinopathy^[12] can all lead to VH in children as stated earlier, a fact which was confirmed by our findings. Vasculitis and hematological disorders accounted for the majority of cases in the spontaneous hemorrhage group. Most patients could be managed without resorting to incisional surgery. Furthermore, the number of patients with vasculitis was high (44%) in our series, in contrast to large earlier reports from the West (0.5%).^[2] Our findings corroborate the results of Indian studies (approximately 48% in the study by Rishi et al); however, the exact percentage of vasculitis patients in other series who had bilateral VH is not known, given that this entity has never been analyzed separately. VH secondary to diabetic retinopathy appears to be rare in the age group under study according to the previous literature, although proliferative diabetic retinopathy has been well described among adolescents.^[22]

Ultrasonography in our series, except in cases of intraocular foreign body did not seem to substantially enhance the diagnostic ability. The overall anatomical outcomes were good in our series, probably due to

Table 2. USG findings in the traumatic and spontaneous (nontraumatic) vitreous hemorrhage groups at presentation

USG findings at presentation	Traumatic (37 eyes)	Spontaneous (nontraumatic) (48 eyes)
Posterior capsular rupture	3	0
Lens dislocation/subluxation	3	0
Vitreous hemorrhage	74	96
Intraocular foreign body	2	0
Retinal detachment	27	8
Choroidal detachment	11	0

USG, ultrasonography

the tendency of bilateral hemorrhage to present early before irreversible chronic damage occurs. Such patients are also more likely to agree with early intervention if required; moreover, considering the visual disability and the threat of visual deprivation and subsequent amblyopia in this group, the treating surgeon would like to encourage early treatment.

Closed globe injuries^[2,22] and spontaneous hemorrhage secondary to vasculitis and hematological disorders have better visual and anatomical outcomes, especially if there is no foveal involvement.^[23] These three causes accounted for most of the patients in our series, and hence the functional outcomes were reasonable from the point of view of ambulatory vision. The spontaneous hemorrhage group gained significantly better function as compared to traumatic cases in which coexistent damage to the eye may reduce eventual visual recovery. Trauma cases were also more likely to undergo surgery for retinal detachment or similar conditions. Our overall surgical rate compares favorably with other series, in spite of bi-laterality of the condition.^[1,2]

To conclude, bilateral VH in children has a number of causes, varying between regions and thus requiring different management strategies. The current study identifies hitherto unknown etiologies of bilateral VH, viz. trauma in general and firecracker injuries in particular, and describes the clinical features and outcomes that identify these causes. Whereas these patients tend to present early, the risk of visual deprivation and amblyopia as well as the detrimental effects of the disease process itself may lead to unsatisfactory effects, a point necessary to be considered while counseling. A wider array of preventive and screening measures is thus required to prevent disability secondary to the stated causes in children. These include public education regarding recreational activities and protective gear as well as appropriate educational campaigns at the time of high risk activities such as Diwali.

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Conflicts of Interest

There are no conflicts of interest.

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