

Clinical profile and surgical outcome of pars plana vitrectomy in non-diabetic vitreous hemorrhage

Ruchi Shrestha , Ritesh Kumar Shah, Purushottam Joshi and Sanket Parajuli

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Abstract

Background: Spontaneous vitreous hemorrhage is one of the common causes of ocular emergency. There are very few prospective studies on the clinical profile and surgical outcomes for patients with dense vitreous hemorrhage caused by non-diabetic and non-traumatic till date to our knowledge.

Objectives: This study was conducted to better understand the etiologies, clinical profile, surgical outcome, and visual prognosis following pars plana vitrectomy for dense vitreous hemorrhage in adults with non-traumatic and non-diabetic retinopathy.

Design: This was a prospective interventional study.

Methods: This study was conducted in Mechi Eye Hospital (Birtamod, Nepal) from October 2018 to September 2019. All consecutive cases, 46 eyes of 46 patients, with vitreous hemorrhage that underwent vitrectomy were included in our study. There were 14 (30.4%) female and 32 (69.6%) male patients, and the average age at presentation was 43.74 ± 16.19 (17–84) years. The success rate of surgery in terms of visual outcome was evaluated.

Results: The most common cause of vitreous hemorrhage was retinal vasculitis with fibrovascular changes and vascular sheathing 19 (41%). The indication of vitrectomy on patient demand was 20 (43.5%). Success rate of surgery in terms of visual outcome (functional outcome) was defined as final visual acuity of $>6/60$ which was 86.9%.

Conclusion: The most common cause of spontaneous vitreous hemorrhage in our study was retinal vasculitis with fibrovascular changes and vascular sheathing. Vitrectomy has a good surgical outcome for spontaneous vitreous hemorrhage in terms of visual outcome (functional outcome) unless guarded by other factors like chorioretinal atrophy followed by optic atrophy and epiretinal membrane.

Keywords: functional outcome, non-diabetic, non-traumatic, pars plana vitrectomy, spontaneous vitreous hemorrhage, surgical outcome

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Background

Spontaneous vitreous hemorrhage is one of the common causes of ocular emergency. It presents with sudden visual loss and floaters. The incidence of spontaneous vitreous hemorrhage occurs in approximately seven cases per 100,000 individuals.¹ The most common causes of spontaneous vitreous hemorrhage are proliferative diabetic retinopathy (32%), retinal tear (30%), proliferative retinopathy secondary to retinal vein

occlusion (11%), and posterior vitreous detachment (PVD) without retinal tear (8%).^{1,2}

Without complete ophthalmological examination, spontaneous vitreous hemorrhage causes a serious diagnostic dilemma for an ophthalmologist. Factors such as age, hypertension, diabetes mellitus, stroke, head trauma, leukemia or hemorrhagic diathesis, and anticoagulant or immunosuppressives should be considered. Detailed

Correspondence to:

Ruchi Shrestha
Reiyukai Eiko Masunaga
Eye Hospital, Budol,
Banepa-6, Nepal
druchishrestha@gmail.com

Ritesh Kumar Shah
Mechi Netralaya,
Kakarvitta, Nepal

Purushottam Joshi
Mechi Eye Hospital,
Birtamod, Nepal

Sanket Parajuli
Reiyukai Eiko Masunaga
Eye Hospital, Banepa,
Nepal

examination of fellow eye also gives the diagnostic clue. PVD associated with a retinal tear is the most likely diagnosis in cases with no diagnostic clue.^{1,2}

Vitreous hemorrhage can be treated conservatively if there is spontaneous clearing of the vitreous for about 6 months. It involves keeping the head in an upright position and immobilization to promote settling and gradual absorption of the blood. Conservative approach for dense vitreous hemorrhage has potential risks like retinal detachment, glaucoma, and pigmentary retinopathy. Therefore, clinicians prefer more aggressive treatment with a vitrectomy. Pars plana vitrectomy should be done urgently with respect to retinal tears with or without retinal detachment.³⁻⁵

There are plenty of retrospective studies on vitreous hemorrhage caused by proliferative diabetic retinopathy and trauma. There are very few prospective studies on the clinical profile and surgical outcomes for patients with dense vitreous hemorrhage caused by non-diabetic and non-traumatic till date to our knowledge. Therefore, we conducted this prospective study to better understand the etiologies, clinical profile, surgical outcome, and visual prognosis following pars plana vitrectomy for dense vitreous hemorrhage in adults with non-traumatic and non-diabetic retinopathy.

Materials and methodology

This was a prospective study done in Mechi Eye Hospital (Birtamod, Nepal) from October 2018 to September 2019 for a period of 1 year. All consecutive cases with vitreous hemorrhage that underwent vitrectomy were included.

The demographic data including age and sex of the patient were recorded. All patients underwent a comprehensive ophthalmic examination including visual acuity, applanation tonometry, slit lamp examination, gonioscopy, indirect ophthalmoscopy, and B-scan ultrasound. In all cases of retinal vasculitis, we did a set of blood investigations to rule out few cases, but in some cases, secondary cause was not established. Therefore, most cases were presumed to be Eales. Routine set of blood tests included complete blood count (CBC), erythrocyte sedimentation rate (ESR), Mantoux Test, venereal disease research laboratory (VDRL), human immuno deficiency virus (HIV), hepatitis B antigen, rheumatoid factor,

and chest X-ray were done post-operatively when retinal vasculitis was suspected. However, many other tests which could have helped in detailed evaluation were not done due to financial constraints of the patients and patients' denial in others where there was improvement in vision following surgery. Moreover the retinal picture at the time of surgery after clearing VH were typical of vasculitis such as peripheral venous or arteriolar sheathing suggestive of retinal phlebitis or arteriolitis or both. Similarly, in other cases, neovascular fronds with retinal traction along with vascular sheathing were common findings.

All patients were operated at Mechi Eye Hospital. The severity of vitreous hemorrhage was graded on a 5-point scale from a previous study: Grade 0 (no vitreous hemorrhage); Grade 1 (minimal vitreous hemorrhage, optic disk, and retinal vessels were clearly visible); Grade 2 (mild vitreous hemorrhage, most of the optic disk, and retinal vessels were visible); Grade 3 (moderate vitreous hemorrhage, optic disk, or retinal vessels were barely visible); and Grade 4 (severe vitreous hemorrhage was too dense to allow visualization of the optic disk).⁶ Early vitrectomy was defined as the time between decision for surgery and actual surgery if done within 7 days. We included cases with early vitrectomy for vitreous hemorrhage of Grade 3 or 4 that had a follow-up of at least 3 months. The cause of vitreous hemorrhage was noted during surgery.

Under aseptic precautions and after peribulbar anesthesia, 23-gauge trochar was inserted to make a triport for vitrectomy. Vitreous base was thoroughly shaved with indentation by a scleral depressor. Laser photocoagulation (endolaser) was applied based on the intraoperative findings. The ports were closed under fluid/air or gas (C3F8) or silicone oil based on the need of intraocular tamponade. Silicon oil was used as tamponade in retinal detachment cases, iatrogenic break and combined retinal detachment. C3F8 was used in vasculitis cases with profound neovascular proliferation with chances of rebleeding. After vitrectomy surgery, the post-operative visual acuity was taken at first post-operative day, 1 month and 3 months follow-up. We excluded diabetic and traumatic vitreous hemorrhage in our study.

Data were entered and analyzed in SPSS version 20 statistical software. Ethical approval was granted by the local institutional review committee of Mechi Eye Hospital (30-09-2018), and all

patients provided a written informed consent for the study.

Results

Forty-six eyes of 46 patients with vitreous hemorrhage were included in our study. There were 14 (30.4%) female and 32 (69.6%) males in our study. The mean age of presentation of vitreous hemorrhage in years was 43.74 ± 16.19 (17–84) years.

Vitreous hemorrhage was associated with hypertension in 45.7% (21) eyes followed by viral hepatitis in 2.2% (1) eye. No other systemic disease, history of anticoagulants, and immunosuppressive were associated in our study.

The most common cause of vitreous hemorrhage was retinal vasculitis with fibrovascular changes and vascular sheathing 19 (41%) followed by branch retinal vein occlusion (BRVO) 16 (34.7%), central retinal vein occlusion 3 (6.5%), retinal break without retinal detachment 3 (6.5%), retinal detachment 3 (6.5%), and exudative age-related macular degeneration (AMD) in 2 (4.3%) patients.

The diagnostic clues of retinal vasculitis in fellow eyes were found in 15 eyes. Six (13.04%) eyes had signs of hypertensive retinopathy, 2 (4.34%) eyes had disciform macular scar in the fellow eye, 4 (8.69%) eyes already underwent vitrectomy for vitreous hemorrhage in the fellow eye and 3 (6.52%) patients had no vision. Sixteen eyes had no diagnostic clues in fellow eyes.

The mean duration of symptoms at the time of referral in months was 5 ± 3.9 (range: 0.06–12). The mean duration of signs and symptoms to surgery was 83.15 ± 115.91 (range: 1–720) days.

The indication of vitrectomy on patient demand was 20 (43.5%), non-clearing vitreous hemorrhage >6 months was 19 (41.3%), monocularly was 6 (13%), and retinal detachment was 1 (2.2%).

Intravitreal per-fluoro-propane (C3F8) gas was used as tamponade agent after vitrectomy in 25 (54.3%) eyes, silicone oil was used in 12 (26.1%), and intravitreal air was used in 2 (4.3%) eyes. No tamponade was used in 7 (15.2%) of vitrectomy patients.

The best corrected visual acuity (BCVA) at presentation was 1.76 ± 0.25 (range: 0.77–1.94)

LogMAR which increased to 0.58 ± 0.31 (range: 0.00–1.77) LogMAR after 3 months of vitrectomy. Pre-operatively, the BCVA was perception of light (PL) in 5 (10.9%) eyes, hand movement (HM) in 18 (39.1%), finger count (FC) in 8 (17.4%), 1/60 in 7 (15.2%), 2/60 in 5 (10.95%), 3/60 in 1 (2.2%), 5/60 in 1 (2.2%), and only 1 (2.2%) eye had 6/36 visual acuity. The BCVA increased to 6/36 and above in 39 (84.8%) eyes and less than 6/60 in only 7 (15.2%) eyes.

Relative afferent pupillary defect (RAPD) was present in 6 (13.04%). There was no correlation between RAPD and final visual outcome. The causes of poor visual outcome less than 6/60 were chorioretinal scar in four eyes, optic atrophy in one eye, and epiretinal membrane formation in one eye. Our success rate of surgery in terms of visual outcome (functional outcome) was defined as final visual acuity of >6/60 which was 86.9%. Statistically significant improvement of final BCVA from preop BCVA was noted with paired *t*-test ($p < 0.001$). The mean gain of post-operative VA among those with intraocular complications was 1.21, whereas without any intraocular complications was 1.71. However, the statistical test was not significant to assume poor visual outcome was solely due to intraoperative complications (independent *t*-test). We did not find any correlation between initial visual acuity, duration of symptoms, and final visual acuity. There was no significant correlation between age and visual outcome (Table 1).

Discussion

The purpose of our study is to determine the clinical profile and surgical outcome of non-traumatic and non-diabetic vitreous hemorrhage.

Non-oculo-traumatic and non-diabetic vitreous hemorrhage (NDVH) are caused by a wide variety of disease.⁵ Early vitrectomy has good outcome and low complication rate for dense vitreous hemorrhage in adults with non-traumatic and non-diabetic retinopathy.^{6,7} Vitrectomy may result in a significant increase in visual acuity in eyes with non-traumatic NDVH other than cases with CNV and CRVO; pathologic changes in the macula prevent significant visual improvement in these cases.⁸

Age and male gender under anti-coagulation drugs are the potential risk factors associated with the incidence of VH. The incidence of vitreous

Table 1. Table showing clinical profile and surgical outcome of pars plana vitrectomy.

Variables	Values	
Gender, <i>n</i> (%)		
Male	14 (30.4%)	
Female	32 (69.6%)	
Mean age in years, $\bar{x} \pm$ SD (range)	43.74 \pm 16.19 (17–84) years	
	<i>n</i> (%)	Mean age, $\bar{x} \pm$ SD (years)
Causes of vitreous hemorrhage		
BRVO	16 (34.7%)	57.19 \pm 7.04
CRVO	3 (6.5%)	46.33 \pm 9.01
Vasculitis	19 (41.3%)	31.89 \pm 11.16
Retinal break without retinal detachment	3 (6.5%)	31.67 \pm 7.37
Retinal detachment	3 (6.5%)	41.67 \pm 20.84
Exudative AMD	2 (4.3%)	66 \pm 25.45
Lens status, <i>n</i> (%)		
Clear lens	29 (63.0%)	
Cataract	12 (26.1%)	
Pseudophakic	5 (10.9%)	
Aphakia	46 (100%)	
Duration of symptom in months, $\bar{x} \pm$ SD (range)	5 \pm 3.9 (range: 0.06–12)	
Indication of vitrectomy, <i>n</i> (%)		
Non-clearing vitreous hemorrhage	6 (13.0%)	
Bilateral vitreous hemorrhage	19 (41.3%)	
Monoocularity	20 (43.5%)	
Tractional RD threatening macula	1 (2.2%)	
Patient’s demand	46 (100%)	
Retinal detachment	6 (13.0%)	
Intravitreal C3F8/silicone oil use		
C3F8	25 (54.3%)	
Silicone oil	12 (26.1%)	
Air	2 (4.3%)	
None	7 (15.2%)	
Post-operative complications, <i>n</i> (17.4%)		
Rebleeding	2 (4.3%)	
Retinal break	2 (4.3%)	
Cataract	4 (8.7%)	
BCVA of the affected eye, $\bar{x} \pm$ SD (range)		
At presentation	1.76 \pm 0.25 (range: 0.77–1.94) LogMAR	
Post-operative 3 months	0.58 \pm 0.31 (range: 0.00–1.77) LogMAR	
AMD, age-related macular degeneration; BCVA, best corrected visual acuity; BRVO, branch retinal vein occlusion; CRVO, central retinal vein occlusion; RD, retinal detachment.		

hemorrhage increased significantly between 40 and 59 years age and in the males.⁹ This is similar to our study as the mean age of presentation of vitreous hemorrhage was 43.74 ± 16.19 (17–84) years and the number of males were higher 32 (68.6%). In another study by Moradian *et al.*,⁸ majority of patients were also middle aged to old, but there was no gender bias.

The mean duration of symptoms at the time of referral in months was 5 ± 3.9 (1 day–24 months) which was similar to study done by Moradian *et al.* was 6.2 ± 2.8 months (18 days to 36 months). Moradian *et al.* the mean interval between referral and vitrectomy was 90 ± 62 (2–230) days. In our study, the mean interval between referral and vitrectomy was mean days from signs and symptoms to surgery 83.15 ± 115.91 (range: 1–720) days. There was no significant correlation between final visual acuity and pre-operative duration of symptoms similar to study done by Verbraken and Van Egmond and Singalavanija *et al.*

The most common cause of vitreous hemorrhage in our study was retinal vasculitis with fibrovascular changes and vascular sheathing 19 (41%) followed by BRVO 16 (34.7%), central retinal vein occlusion 3 (6.5%), retinal break without retinal detachment 3 (6.5%), retinal detachment 3 (6.5%), and exudative AMD in 2 (4.3%) patients. The most common systemic association of vitreous hemorrhage in our study was hypertension. About 45.7% cases were associated with hypertension matching the finding of 43% cases of hypertension in study done by Moradian *et al.* Zhang *et al.*,⁶ Moradian *et al.*,⁸ and Kim *et al.*¹⁰ found the most common cause of vitreous hemorrhage to be retinal vein occlusion in contrast to ours being retinal vasculitis. A cross-sectional study done in Nepal also described retinal vasculitis as the most common causes of spontaneous vitreous hemorrhage in adults after proliferative diabetic retinopathy like ours. They also presumed Eales disease to be the most common cause of retinal vasculitis in Nepal as diagnosis was not established from the investigations.¹¹

We found 30 (65.2%) eyes had diagnostic clues in the fellow eye and three had already lost their vision in the fellow eyes. Sixteen had no diagnostic clues in fellow eyes. Moradian *et al.* found similar findings in 13 (26.5%) eyes while Hasenfratz *et al.* found similar findings in 57% of eyes.^{8,12}

The most common indication of vitrectomy in our study was patient demand 20 (43.5%) followed by non-clearing vitreous hemorrhage >6 months 19 (41.3%), monocular 6 (13%), and retinal detachment was 1 (2.2%). Similar indication was seen in study by Moradian *et al.* but the percentage of each indication is unknown in the study.

The initial visual acuity is a predictive value for final visual acuity although it does not help in diagnosis of vitreous hemorrhage.⁵ The BCVA at presentation was 1.76 ± 0.25 (range: 0.77–1.94) LogMAR which increased to 0.58 ± 0.31 (range: 0.00–1.77) LogMAR after 3 months of vitrectomy. But we did not find any correlation between initial visual acuity and final visual acuity. Similar to the study done by Moradian *et al.* and Singalavanija *et al.*¹³ The presence of RAPD also had no significant correlation with the final visual outcome. There was no significant correlation between age and visual outcome. In contrast to our study, the definitive predictive value for every 1 year older age was associated with 0.02 decreases in VA logMAR in a study done by Moradian *et al.*⁸

The success rate of surgery in terms of visual outcome (functional outcome) was defined as final visual acuity of >6/60 which was 86.9%. Zhang *et al.* in their study found that early vitrectomy for non-traumatic and non-diabetic vitreous hemorrhage was good outcome like ours with low complication rates. Vitrectomy combined with laser photocoagulation and with or without tamponade agents according to the etiology is the recommended treatment for vitreous hemorrhage.⁶ The causes of poor visual outcome less than 6/60 were chorioretinal scar in four eyes, optic atrophy in one eye and epiretinal membrane formation in one eye. The complications of vitrectomy were seen in 8 (17.4%) eyes. Re-bleeding occurred in two eyes, four developed cataracts due to lenticular touch and two developed iatrogenic retinal break. Moradian *et al.*⁸ also found success rate of 78% after vitrectomy similar to our study. Kim *et al.*¹⁰ in their study found that old patients with poor pre-operative BCVA in both eyes and AMD are at a higher risk of poor visual prognosis following vitrectomy.

Limitation of our study is that we conducted this prospective study for a period of 1 year only. The final post-operative follow-up in our study was 3 months which could have been longer. The sample size of our study was small, and this

could have affected the strength of our analysis. Further prospective studies are required with longer study period, longer follow-up, and larger sample size.

Conclusion

The most common cause of spontaneous vitreous hemorrhage in our study was retinal vasculitis with fibrovascular changes and vascular sheathing followed by BRVO, central retinal vein occlusion, retinal break without retinal detachment, retinal detachment, and exudative AMD in patients. Vitrectomy has a good surgical outcome for spontaneous vitreous hemorrhage in terms of visual outcome (functional outcome). The most common cause of poor visual outcome were chorioretinal atrophy followed by optic atrophy and epiretinal membrane.

Author contributions

Ruchi Shrestha: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Supervision; Validation; Writing – original draft; Writing – review & editing.

Ritesh Kumar Shah: Conceptualization; Investigation; Methodology; Supervision; Writing – review & editing.

Purushottam Joshi: Formal analysis; Supervision; Validation; Writing – review & editing.

Sanket Parajuli: Data curation; Formal analysis; Software; Writing – review & editing.

Conflict of interest statement

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ORCID iD

Ruchi Shrestha  <https://orcid.org/0000-0003-1570-621X>

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