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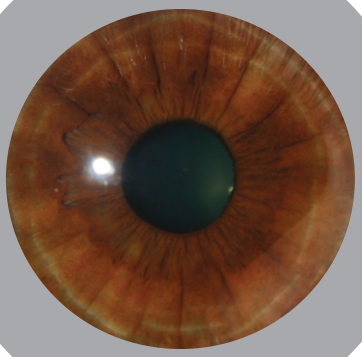

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Original Article

Incidence of rebleed following 23 gauge transconjunctival sutureless vitrectomy for vitreous hemorrhage due to vascular etiologies

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Context: There has been speculation among surgeons on whether the incidence of rebleeds is higher whilst using the small gauge surgery and the concern is probably due to the higher reported incidence of post-operative hypotony in sutureless wounds. Hence, we carried out this study to report the incidence of rebleed following 23 gauge transconjunctival sutureless vitrectomy (TSV) for vitreous hemorrhage (VH) due to vascular etiologies. **Aims:** The aim of our study was to study the incidence of rebleed following 23 gauge TSV for VH due to vascular etiologies. **Settings and Design:** Retrospective case series. **Materials and Methods:** One hundred and nineteen eyes underwent 23-gauge TSV for VH due to proliferative diabetic retinopathy (*n* = 95), retinal vein occlusion (*n* = 15) and vasculitis (*n* = 9). Patients were examined post-operatively on day 1, 30, 90, and finally at 180 days. **Statistical Analysis Used:** Paired *t*-test and Fisher test. **Results:** Rebleed was noted in 17 patients of whom 3 had spontaneous clearance while 14 (11.8%) had a non-clearing post-operative vitreous hemorrhage. Of these 14 eyes, re-vitrectomy was performed in 8 eyes while six patients underwent air blood exchange. **Conclusions:** The incidence of non-clearing VH requiring intervention following 23 gauge TSV is 11.8%. All the eyes had clear media at final follow-up.

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Pars plana vitrectomy (PPV) is a well-established treatment for vitreous hemorrhage (VH) due to various causes. One of the most revolutionary developments in vitreoretinal surgery over the past few years has been transconjunctival sutureless vitrectomy (TSV). Fuji *et al*., introduced the 25-gauge TSV in 2002 and 3 years later, based on the same surgical principle, Eckardt developed the 23-gauge TSV.[1,2] Compared to the traditional 20-gauge vitrectomy system, the 23-gauge system allows for small incision, self-sealing, sutureless transconjunctival pars plana sclerotomies. This offers a number of potential advantages including decreased surgical trauma, less post-operative inflammation, and faster post-operative recovery time.[3] Eliminating suturing may also shorten total operating time.[4]

Early studies found VH to be present in the early post-operative period in up to 63% of eyes, with clearance of the hemorrhage occurring on an average at 9.1 weeks post-operatively in phakic eyes.[5] Early post-operative vitreous hemorrhage (POVH) may occur due to residual blood clots in the peripheral vitreous, iatrogenic injury and incomplete removal of fibrovascular tissue.[5,6] Even with careful and complete intraoperative removal of blood clots and fibrovascular tissue, rebleeding can still occur from the blood-vessel breakdown secondary to damage incurred during dissection of fibrovascular membranes.[7,8]

Some studies have shown; however, that a common cause of recurrent hemorrhage is new vessel growth at the inner sclerostomy sites associated with fibrous traction.[9-11] A strong association has been noted between the presence of POVH more than 2 months post-operatively and evidence of fibrovascular ingrowth either on ultrasonic Biomicroscopy or 20-MHz high-resolution anterior-segment ultrasonography.[10-12]

The incidence of POVH in patients undergoing 20 gauge PPV for VH in proliferative diabetic retinopathy (PDR) is around 29 to75%.[5,8,13,14] However, there are no studies until the date to report exclusively the final outcomes of eyes that undergo sutureless vitrectomy using 23 gauge for VH exclusively due to vascular etiologies.

The purpose of our study was to study the incidence of rebleed following 23 gauge TSV and interventions carried out for the same.

Materials and Methods

After institutional board review approval, charts of patients who underwent 23 gauge TSV by a single surgeon (MN) over a 5 year period for VH due to vascular etiologies were reviewed.

Data abstracted from these charts included patient age, gender, date of operation, indication for surgery, operative eye, visual acuity (VA) (pre-operative visit, post-operative day 1, 30, 90 and 180), intraocular pressure (IOP) (pre-operative visit, post-operative day 1, and monthly post-operative visits), phakic status (phakic, cataract, pseudophakic, aphakic), anterior and posterior segment findings, pre-operative laser photocoagulation and anti-Vascular endothelial growth factor (VEGF) injections. Ultrasonography findings were noted in eyes, which had a pre-retinal hemorrhage that obscured clear fundus visualization. Detailed history of co-incidental and past systemic and ocular pathologies and procedures was noted. Data regarding the onset and treatment of recurrent VH, and post-operative follow-up were also compiled.

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Presence of co-incidental ocular pathologies (e.g., glaucoma, uveitis, retinal degenerations, and dystrophies etc.) and retinal detachment, and blood dyscrasias associated with abnormal coagulation were considered as exclusion criteria. Subjects that underwent silicone oil injection or simultaneous vitrectomy with any other surgery were also not included in the study. Any patient who required sutures to be taken for one or more ports at the end of surgery was also excluded.

All the patients were operated under peribulbar anesthesia. The operative technique was 3-port 23 gauge PPV using self-sealing sclerotomies. Immediately prior to making the incisions, the eye was washed with a jet of saline and a few drops of povidone iodine drops were instilled to address conjunctival flora. The Trocar Fixation plate (pressure plate forceps) from Asico (Westmont, IL) was used so as to stabilize the globe while making the biplanar incision. The pressure plate forceps have an incorporated caliper to measure distance from the limbus apart and have serrations on the undersurfaces, allowing a good hold on the conjunctiva for misalignment over the proposed scleral entry. Sclerotomies were created between 3.5 mm and 4 mm posterior to the limbus for pseudophakic and phakic patients respectively in the superonasal, superotemporal, and inferotemporal quadrants. Initially, the blade was inserted obliquely into the sclera at an angle of about 30°-45° up to the cannula mark. Then, the direction of the blade was adjusted perpendicular to the sclera as it is inserted into the vitreous cavity. The biplanar incision not only holds the cannula in place, but also prevents egress of fluid in the post-operative period.

After core vitrectomy, wherever indicated posterior vitreous detachment was induced followed by peripheral vitrectomy. The areas of active neovascularization were recognized and cauterized before dissection. In order to tackle the intraocular bleeding, IOP was raised instantly to control intraocular bleeding. If required, meticulous endodiathermy was carried out using the unipolar cautery. Supplementary laser panretinal photocoagulation extending beyond the level of the equator was performed. After the vitrectomy, the infusion pressure was lowered to 15 mm Hg and cannula plugged to prevent egress of fluid. The wound area was massaged with a blunt tip applicator for 10-15 s which allow a better sealing of the scleral fibers and prevents any inadvertent vitreous incarceration. A drop of povidone-iodine is then instilled followed by a subconjunctival antibiotic injection in the inferonasal quadrant.

All patients with recurrent or non-clearing vitreous hemorrhage (NCVH) on 1 month follow up underwent Ultrasound B scan to rule out a retinal detachment. Usually they were asked to follow-up with conservative management for another month (2 months from surgery). At this stage intervention in the form of air blood exchange or re vitrectomy was carried out in eyes with persisting hemorrhage. Eyes which showed low intensity uniform echoes on ultrasound suggestive of VH underwent air blood exchange while those where there were multiple dense echoes or any signs of proliferations or membranes were posted for revision vitrectomy.

A standard 23 gauge vitrectomy was carried out. The residual hemorrhage was cleared and the retinal status was evaluated. Additional laser and/or diathermy procedures were carried out as required.

Air blood exchange was carried out through the pars plana, done in the operating room using a 24 G needle attached to a three way cannula and 10 cc syringe. Air was first injected, followed by drainage of some fluid passively; this was repeated until the entire vitreous cavity is filled with air, at which the needle is withdrawn.

Snellen VAs was converted into logarithm of the minimum angle of resolution (logMAR). The paired *t*-test was used to compare means with a statistical significance threshold at $P < 0.05$.

Results

A total of 119 eyes of 119 patients were identified that met the inclusion criteria. The mean age was 50 years, and 89 patients were male and 30 female. VH due to PDR (95 eyes; 79.8%), retinal vein occlusion (15 eyes; 12.6%) and vasculitis (9 eyes; 7.6%) were the three most common indications for surgery. Sixty four eyes had a history of laser panretinal photocoagulation done previously, whereas preparatory intravitreal anti-VEGF injections were administered in 18 eyes. Demographic data of patients included in the study is summarized in Table 1.

Follow-up in all patients was for a minimum of 6 months with no patients lost during this period. Mean pre-operative VA was 2.0 logMAR, which improved post-operatively to 1.2 logMAR at 1 month and 0.78 logMAR at 6 months. The improvement in VA at post-operative review was statistically significant ($P < 0.05$).

Rebleed was noted in seventeen patients of whom 3 cleared spontaneously within 2 months of surgery while 14 patients required intervention for non-resolving POVH. Revision 23 gauge TSV was performed in 8 eyes, while six patients underwent air blood exchange. Of the 14 eyes with NCVH, the underlying etiology was PDR in 13 eyes and 10 of these eyes were phakic. fifty percent of these had undergone panretinal photocoagulation previously and three patients had undergone preparatory anti-

Table 1: Demographic data of patients with vitreous hemorrhage

Demographics	(%)
Total no of eyes	119
Average age±SD	50.54
Gender	
Males	89 (74.8)
Females	30 (25.2)
Indication for surgery	
Vitreous hemorrhage and subhyaloid hemorrhage due to proliferative diabetic retinopathy	95 (79.8)
Vitreous hemorrhage due to vein occlusion	15 (12.6)
Vitreous hemorrhage due to vasculitis	9 (7.6)
Lens status at the time of surgery	
Phakic	103 (86.65)
Pseudophakic/aphakic	16 (13.4)
Prior panretinal photocoagulation	64 (53.8)
Preparatory anti-VEGF	18 (15.1)

VEGF: Vascular endothelial growth factor

VEGF. Data of patients undergoing interventions for re-VH is summarized in Table 2.

All the patients had clear media and attached retina at the end of final follow-up.

In eyes that underwent revision 23 gauges vitrectomy, the final post-operative VA was 1.0 logMAR at 6 months while those undergoing air blood exchanges had a final VA of 1.05.

There were no instances of post-operative hypotony, endophthalmitis, rhegmatogenous retinal detachment, and neovascular glaucoma in this series.

Discussion

Traditionally, in the past most vitrectomy surgical systems have utilized the 20-gauge instruments for PPV. These sclerotomies require conjunctival peritomy and have a 1.15 mm width, which require suturing compared to 0.72 mm sclerotomies with 23-gauge sutureless TSV. The 23-gauge TSV system combines the advantages of decreased surgical trauma and recovery time enjoyed with 25-G TSV with the sturdier instrumentation and fluidics of the 20 G vitrectomy system, making it a promising approach to efficiently and safely tackle the complete range of vitreoretinal surgical procedures with a single system.[15]

Incidence rates of POVH after vitrectomy for PDR vary substantially in the literature. Schachat *et al*., and Novak *et al*., reported incidence rates of immediate POVH of 75% and 63%, respectively and recurrent VH of 29% and 23%, respectively.[5,13] However, both these reports were published more than 20 years ago and predate modern vitrectomy instrumentation and techniques.

Recent advances in surgical techniques have improved the safety of the procedure, anatomical success, and final visual outcome.[16,17]

A 10 year retrospective analysis of patients undergoing 20G PPV from January 1999 to May 2010 by Gupta *et al*., for tractional retinal detachment (TRD) and NCVH secondary to PDR in 346 eyes had an incidence of 9.2% patients requiring intervention for non-clearing post vitrectomy hemorrhage.[18]

Ivastinovic *et al*., in a randomized clinical trial compared 23-gauge and 20-gauge vitrectomy for diabetic VH regarding post-operative vitreous hemorrhage (PVH), re-operation rates, VA and safety profiles.[12] Though the final VA averaged 0.68 logmar in the 23-gauge group, the incidence of early (20%) and late (22.2%) POVH was higher as compared to our study (11.8%). In their series, post-operative hypotony was observed in 8.9% of cases and rhegmatogenous retinal detachment occurred in one eye.

Incidence of POVH following pre-operative intravitreal Bevacizumab varies from 13% to 25% in different studies. Use of intravitreal Bevacizumab being given prior to surgery for the purpose of regressing neovascularization has been reported by Chen and Park.[19] Yeoh *et al*., and Ishikawa *et al*., reported improvement in surgical ease and decrease in surgical bleed in small series of patients.[20,21] Similar results were demonstrated by Rizzo *et al*., and Ahmadieh *et al*.,[22,23] In a prospective clinical trial at our institute, it was noted that pre-operative intravitreal Bevacizumab injection for diabetic TRD facilitates the surgery, decrease the amount of intraoperative bleeding, decrease the rate of POVH and improves VA.

In our study, the eyes which have rebleed do seem to have preponderance to diabetic retinopathy as well as phakic status. The overall number of diabetic patients is higher in our inclusion group and hence difficult to know if this preponderance is significant or not. However most of these eyes being phakic does seem to confirm the fact that it becomes difficult to do a thorough peripheral clean up in these eyes and could be responsible for peripheral reproliferations leading to rebleeding.

Table 2: Data of patients with re-vitreous hemorrhage

Patient No.	Underlying cause	Preparatory anti-VEGF	Prior PRP	Onset of re- VH months)	Procedure	Final visual acuity logMAR
1	PDR	No	No	2½	Re-vitrectomy	1.6
2	Retinal vein occlusion	Yes	No	6	Re-vitrectomy	2
3	PDR	No	Yes	1	Air blood exchange	2
4	PDR	No	No	1	Re-vitrectomy	0.78
5	PDR	No	Yes	1	Air blood exchange	1.2
6	PDR	No	No	7	Re-vitrectomy+anti-VEGF	1.1
7	PDR	No	Yes	10	Re-vitrectomy	0.48
8	PDR	Yes	Yes	3	Air blood exchange	1.2
9	PDR	No	Yes	2	Re-vitrectomy	2
10	PDR	No	Yes	2	Air blood exchange	1.3
11	PDR	Yes	No	1½	Re-vitrectomy	0.18
12	PDR	No	Yes	6	Re-vitrectomy	0.48
13	PDR	No	No	1	Air blood exchange	1
14	PDR	No	No	2½	Air blood exchange	0.18

PDR: Proliferative diabetic retinopathy, VEGF: Vascular endothelial growth factor, PRP: Pan retinal photocoagulation, logMAR, Logarithm of the Minimum Angle of Resolution, VH: Vitreous hemorrhage

Our study is retrospective in nature and has limited number of patients. Moreover we have considered eyes with VH due to three etiologies such as diabetic retinopathy, venous occlusion and vasculitis. However, there are no available reports on incidence of rebleeding after sutureless surgery and a larger prospective study comparing both could look at these variables individually in relation to bleeding.

The incidence of POVH in our study was 11.8%, which appears to be comparable to reported incidence following 20 gauge vitrectomy. There has been speculation amongst surgeons on whether the incidence of rebleeds is higher whilst using small gauge surgery and the concern is probably due to the higher reported incidence of post-operative hypotony in sutureless wounds. In our series there was no case of hypotony noted and hence the overall rebleed incidence is not very different from the existing reports on 20 gauge vitrectomy.

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