A REVIEW OF THE INDICATIONS, OUTCOMES, AND COMPLICATIONS OF PARS PLANA VITRECTOMY FOR VITREOUS HEMORRHAGE AT AN URBAN EYE HOSPITAL IN NAIROBI, KENYA

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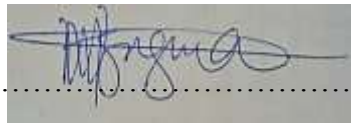
DECLARATION

This dissertation is my original work and has not been presented for a degree at any other university.

Signed……  Date……18/12/2022……

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LIST OF ABREVIATIONS

BRVO- Branch retinal vein occlusion

CRVO- Central retinal vein occlusion

ILM- Internal limiting membrane

PDR- Proliferative diabetic retinopathy

PPV- Pars plana vitrectomy

PRP- Pan-retinal photocoagulation

PVD- Posterior vitreous detachment

VEGF- Vascular endothelial growth factor

VH- Vitreous hemorrhage

AMD – Age Related Macular Degeneration

ABSTRACT

Objective: We aimed to determine the indications of PPV in patients with VH, the complications associated with the surgery, and if the duration of VH affects visual outcomes. **Study Design and Setting:** The study was a retrospective case series in a tertiary eye center (City Eye Hospital) in Kenya for the year 2019-2020. **Materials and Methods:** The census method was used in sampling, and all records of patients that had PPV for VH in 2019-2020 were enlisted. Visual outcomes for these patients were evaluated along with accompanying complications. Pearson coefficient was used to determine correlation between visual outcome and patient presenting features, and any associations with a p-value of <0.05 were included in a multivariable analysis according to strength of association. **Results:** 65 eyes of 63 patients were enlisted in the study with a female: male ratio of 1:1.6 and a mean age of 54.9 (SD 16.2) years. 78.5% and 52.4% of patients had diabetes and hypertension respectively. The commonest cause of VH in operated patients was PDR (66.9%), with other causes being CRVO (6.1%), BRVO (4.6%), trauma (3.1%), Eale's and AMD (1.5% each). We noted significant BCVA improvement from baseline, and this change was not affected by gender (P = 0.292), timing of PPV (P = 0.665), density of VH (P = 0.617), and preoperative Anti-VEGF (P = 0.461). The complications encountered were rebleeding (10.8%), cataract in (6.2%), optic atrophy (6.2%), RD in (6.2%) eyes, and high intraocular pressure (6.2%). 66.2% had no postoperative complication. Complications negatively affected vision (p=0.002). **Conclusions**: PDR is the commonest cause of VH in patients that needed PPV. There was significant visual improvement post PPV for VH. The commonest complication was rebleeding.

1INTRODUCTION

Vitreous hemorrhage causes profound visual loss that often improves with prompt management and follow-up. If untreated, the condition resolves spontaneously in some individuals but may complicate to irreversible visual impairment in others. Most studies define vitreous hemorrhage as the presence of blood inside the vitreous compartment of the eye.[1] Pars plana vitrectomy is the commonest procedure performed where the VH persists despite conservative management and aims to restore anatomy and improve vision.[1] In isolated vitreous hemorrhage without underlying ocular and systemic associations, the success rate of PPV is high. The existence of underlying etiologies such as proliferative diabetic retinopathy, venous occlusions, retinal detachment, and trauma often limits the possibility of regaining pre-hemorrhage vision for some patients.

The incidence of vitreous hemorrhage varies between populations. In most of the studies on VH, reported incidence is 7 cases per 100,000 person-years[1, 2, 3]. A recent Taiwanese study put the incidence lower for the country at 4.8 cases per 100,000 person-years in the country[2]. Anatomically, the two important spaces where blood accumulates are the intravitreal and the pre-retinal spaces. Subhyaoid hemorrhage and sub-ILM hemorrhage are variants of vitreous hemorrhage when it occurs in the pre-retinal space. The most common site for VH amongst these sites is the intravitreal cavity. Other places that constitute vitreous hemorrhage when filled with blood are; the bursa premacularis, canal of Hannover, petit canal, Cloquet's canal, and the space of Berger.[1]This study reviewed the indications, outcomes and complications of pars plana vitrectomy for vitreous hemorrhage at City Eye Hospital, a specialized eye hospital in Nairobi, Kenya.

2 LITERATURE REVIEW

The mechanisms of vitreous hemorrhage can broadly be classified into; retinal vascular disorders, ruptured vessels, or breakthrough VH.[4] Angiogenesis resulting from retinal ischemia often results to retinal and vitreous hemorrhages. Most publications report PDR as the commonest finding in patients that had VH.[5] Additional causes of bleeding in this group includes retinal vein occlusions. Vasculitis such as Eale's disease also often leads to VH. Proliferative vascular retinopathies such as retinopathy of prematurity (ROP), pars planitis and sickle cell retinopathy also carry a large risk of bleeding into the vitreous. The risk is reduced in age related macular degeneration.

Blunt or penetrating trauma to the eye is often a cause of VH in male individuals below the age of forty years[6]. Unlike in proliferative vascular retinopathies, vitreous hemorrhage from trauma is often associated with other anatomical eye conditions such as choroidal rupture. Terson syndrome could also result in vitreous hemorrhage post trauma**.[4]** Another common cause of VH is posterior vitreous detachment (PVD) that causes avulsion of any of the retinal or peripapillary vessels. Acute PVD with vitreous hemorrhage is a concern because of its high association with retinal tears and detachments.[7] Ocular inflammation, hematological disorders, tumors, and iatrogenic hemorrhage are also encountered in the etiology of VH.

The treatment of VH is dependent on the etiology, duration of hemorrhage, and other patient factors. Establishing the cause of a vitreous hemorrhage is the most important consideration in determining if treatment is conservative or surgical. The conservative management of vitreous hemorrhage mainly involves following up the patient without any surgical intervention. Unknown causes of vitreous hemorrhage are especially difficult to manage conservatively.[4]

Patients who present with known etiologies of VH such as Terson syndrome, iatrogenic VH, and PDR can also be observed for 2 to 4 weeks[8]. During this period of follow-up, the status of the retina should be easily assessed. Some additional instructions to the patient also include that the patient should avoid heavy lifting, exercise and strenuous work. A non-clearing vitreous hemorrhage indicates failure in conservative management, and most studies consider this an indication for pars plana vitrectomy.[9]

Proliferative retinopathies are the major causes of vitreous hemorrhage. In these cases, Laser photocoagulation should be planned urgently. Pan-retinal photocoagulation (PRP) is supported in many studies as the mainstay mode of treatment for PDR.[9, 10] In one of the landmark studies; there was a lower risk of marked vision loss in subjects that had PRP done for high-risk PDR.[10] The ETDRS suggested that PRP conferred added protection in PDR and severe non proliferative diabetic retinopathy.

Vascular endothelial growth factor (VEGF) is crucial in the etiology of VH in proliferative retinopathies[11]. Consequently, anti VEGF has been used in the treatment of VH and is especially useful to reduce these new blood vessels and prevent them from bleeding during vitrectomy. In fact, retina surgeons use anti VEGF a few days to a week prior to PPV. The other treatment modalities available include; cryotherapy, diathermy, and posterior hyaloidotomy [12]. The current management modalities of VH require specialized ophthalmology centers with good follow-up. Some experimental treatment strategies include the use if streptokinase, urokinase, streptodornase and ultrasound induced hemolysis[12].

Parsplana vitrectomy (PPV) is the main procedure performed by ophthalmologists in the surgical management of VH. It involves the access of posterior chamber through ports made at the

surgical limbus. In non-clearing vitreous hemorrhage, pars plana vitrectomy is the procedure of choice[9]. This involves the physical clearance or removal of the blood from the vitreous. Occasionally, other complementary procedures such as endolaser have to be done due to coexisting retinal conditions. In patients with a coexisting cataract, the surgeon may also decide to do a lens extraction with the placement of an intraocular lens.

Intra-operative complications related to the procedure include a retinal detachment, vitreous hemorrhage, hypotony, and retinal tears. Complications occurring immediately or long after the surgery include; retinal breaks, retinal detachment, cataract, fibrin exudation, glaucoma, band keratopathy, recurrent erosions, pars-planitis, endophthalmitis, and uveitis.

A non-treated vitreous hemorrhage should naturally clear, with improvement of visual acuity where there are no underlying conditions. However, patients could develop hemosiderosis bulbi[13] where they experience loss of peripheral vision, xanthopsia, night blindness, and loss of foveal function[14]. The other complication is glial and fibrovascular proliferation that could result in tractional retinal detachment. Glaucoma also occurs as a complication of vitreous hemorrhage. Ghost cell glaucoma results when red blood cells turn into spherical rigid cells that reach the anterior chamber.[8] Secondary open-angle glaucoma occurs when these rigid ghost cells cause obstruction of the trabecular meshwork. Hemolytic glaucoma and hemosiderotic glaucoma also occur as late complications of VH. Children with VH also run the risk of developing amblyopia if not promptly managed.

The duration of VH is an important factor considered in deciding when to do PPV. Many studies exist on the timing of vitrectomy for VH, the outcomes, and complications of this surgical intervention. In most of the studies on VH, patients sought surgical intervention after

experiencing sudden visual reduction in the affected eye.[15]The prevalence is higher in male patients compared to their female counterparts, with the age at presentation being patients older than 50 years. Additionally, a large number of patients (98.4%) present with unilateral VH.[15] Diabetes and hypertension are the main systemic conditions associated with VH in most of the studies.

2.1 Indications and Timing of Pars plana vitrectomy

A persistent VH warrants the surgical evacuation of vitreous compartment and treatment of the underlying causes. In most studies, vitrectomy is not considered before 3 months of persistent VH.[16, 17] However, patients with VH in proliferative diabetic retinopathy benefit from early PPV[16].Vitrectomy improves media clarity by removing the intraocular blood, releases vitreo-retinal traction, and reduces the risk of macular edema.[18] The toxicity of iron to the retina is also reduced. Visual prognosis is better in early vitrectomy as it prevents the lipid peroxidation and damage of the photoreceptors.[19]

The decision of when to operate patients with vitreous hemorrhage is dependent on its etiology and duration among other factors. The Diabetic Retinopathy Vitrectomy Study (DRVS) informs the timing of vitrectomy in VH for diabetic retinopathy patients.[5]Patients with vitreous hemorrhage were randomized to two groups where early vitrectomy was performed in one group and differed for 1 year in the other.[5] Vitrectomy was done after a year in the deferred group for persistent VH. The results showed that a visual outcome of 20/40 or greater was achieved in one quarter of patients that had early vitrectomy as compared to only 15% in the group where vitrectomy was deferred .[5] These differences were still evident even after 4 years of follow up. Evidence from this study suggests that early vitrectomy is beneficial for type 1 diabetics with

VH, and that most (80%) of type 2 diabetics with VH still need vitrectomy after a year.[5]Although the study demonstrated no long-term benefit between early and late PPV for VH, patients had to endure reduced vision for the period before surgery.[5] The DRVS study took place before major improvements in vitrectomy systems and techniques with the main study starting in 1976. Visual outcomes recorded in the study were confounded by long procedure duration, which required lensectomy and resultant aphakia due to intra-operative cataract formation[20]. Removal of the natural lens predisposed patients to neovascular glaucoma. There was no use of anti-VEGF and the duration under study was a year.

Cunningham, Kai, and Carvounisin 2011 evaluated the outcomes of PPV for non-clearing VH in 47 patients.[21] Most of the patients (37) had PDR with some having vascular occlusions (7) as the cause of the VH. Three patients had trauma, retinal tears and macular degeneration respectively as the underlying cause. Vision improved in 74% of the patients after PPV. Only 2 patients had surgical complications that included retinal breaks and detachment. The procedure was successful in restoring normal retinal anatomy in all but one patient.[21]

2.2 Outcomes and Complications

Current techniques of PPV for VH have better outcomes compared to those used in DRVS. Most studies evaluating the effectiveness of PPV use the best corrected visual acuity as the primary measure of outcome.[8] There is a consistent improvement in best corrected visual acuity in recent studies.[8]A large number of patients undergoing PPV in the setting of PDR were reported to have improved visual acuity in most of the studies looking at PPV for VH.[8] These patients included some with vitreous hemorrhage. Complications reported in the study were intra-operative retinal breaks, postoperative vitreous hemorrhage, and retained silicone oil.

Khuthalia *et al* recorded visual improvement from 20/600 to 20/90 [22]. In their study, the mean follow-up period is 32 weeks, with 32% (56/173) of eyes demonstrating a re-bleed after PPV. Of these, 5% had early re-bleeding, while 8% and 20% had delayed and persistent re-bleeding respectively. Thirteen percent (22/173) of the eyes required a repeat operation: 4 (50%) of 8 in the early group, 8 (62%) of 13 in the delayed group, and 10 (29%) of 35 in the severe persistent group.[22] Mean preoperative logarithm of the minimum angle of resolution visual acuity was 1.5 (Snellen equivalent, approximately 20/600); mean postoperative VA was 0.65 (Snellen equivalent, approximately 20/90), a gain of 0.85 ($P < .0001$) [22]. 27% (34/127 eyes) with complete scatter photocoagulation before undergoing PPV compared with 22 (48%) of 46 eyes with incomplete scatter photocoagulation before undergoing PPV demonstrated postoperative VH ($P = .002$).[22]Younger individuals also had a higher rate of developing post operative vitreous hemorrhage ($P = .022$) as did patients with a natural lens ($P = .036$).[22]

In another study by Lin, Mehta, and Hariprasad, 65 eyes with vitreous hemorrhage were evaluated, with the mean duration of VH being5.49 months[23]. The earliest time of surgery was 5 days with the last patient going to theater after 15 months. In this study, the visual acuity improved by 2.80 lines with no correlation between this improvement and the duration of the VH.[23]PDR remained the most common cause of VH with the other causes being hemiretinal vein occlusion, BRVO, valsalva retinopathy, and choroidal neovascularization with rupture.[23]They concluded that PPV is effective in the treatment of VH.

2.3 Intravitreal Bevacizumab

Several studies suggest the use of anti-VEGF in the reduction of intra-operative complications during PPV. In these studies, patients that received bevacizumab prior to surgery also had better

vision in the postoperative period. Faisal et al conducted a randomized controlled trial in Karahi over a six month period[24]. Half of the 56 patients enrolled for the study received intravitreal bevacizumab (Avastin) before PPV while the other group were not injected with the drug. In 60.7% (17 cases) of the patients that received intravitreal bevacizumab prior to PPV, no bleeding was observed during or after surgery. However, 21.4% (6 eyes) of these patients had mild bleeding. Only 5 cases (17.9%) had severe bleeding that required intervention. In the second non-intervention group, only 2 cases (7.1%) did not have any form of PPV related bleeding. However, 6 cases (21.4%) had mild bleeding and 20 cases (71.4%) had severe bleeding. Consequently, the incidence of intra-operative bleeding was consistently reduced through the use of intravitreal bevacizumab.[24] Although some studies report no change in the recurrence of VH after surgery, the use of preoperative intravitreal anti VEGF reduced intra-operative complications.[24]

2.4 African Studies

There are few studies in Africa discussing the effectiveness of PPV as used in the management of VH. An example of these studies is the retrospective cohort study in South Africa evaluating the outcomes of PPV for advanced PDR.[25] Patients that had VH as a complication of PDR reported sudden loss of vision. At presentation, 23.4% of the participants had a visual acuity of 6/60 or worse in the better eye.[25] Patients waited for an average of 2.9 months for PPV with 26.2% of them attaining significant visual reduction during the waiting period. Additionally, 20.2% of patients had one inoperable eye. Age was an important determinant of outcome with poorer outcomes increasing with increasing age ($p=0.042$).[25] The presence of posterior iatrogenic retinal breaks also resulted in poor visual outcome ($p=0.007$).[25]

In another African Study, VH was a significant indication for PPV. In this analysis carried out by Oluleye in Nigeria, 66 patients had PPV with 45.5% of them having VH as the primary indication of surgery.[26]Dropped intraocular lens contributed to 10.7% of all the indications of PPV for VH. The researcher noted improved visual outcome after surgery[26].

3 JUSTIFICATION

In Kenya, the etiologic indication for VH drainage varies by surgeon and there is a need to assess if the visual outcomes are better if PPV is done earlier or later in the course of the disease.

Secondly, there is need to establish the most common complication encountered during PPV for VH and the factors affecting the frequency of these complications. Such complications could inform national preventive measures for eye care in Kenya.

Although few studies in Africa discuss the efficacy, outcomes, and common complications associated with PPV for VH, our study will evaluate the indications of PPV for VH, its outcomes and complications at a tertiary ophthalmology center in Nairobi, Kenya.

4OBJECTIVES

4.1Main Objective

To review the indications, visual outcomes, and complications of parsplana vitrectomy for vitreous hemorrhage at City Eye Hospital from1st January 2019 to 31st December 2020

4.2 Specific objectives

I. To determine the etiologic indications for PPV in patients with vitreous hemorrhage that were operated at City Eye Hospital
II. To determine the intra-operative, early and late post-operative complications related to plana vitrectomy for vitreous hemorrhage at City Eye Hospital
III. To determine the visual outcomes at 2 weeks, at 1 month, and 3 months post plana vitrectomy for vitreous hemorrhage at City Eye Hospital
IV. To determine if there is significant difference in outcomes if PPV is done early or late in the course of VH

5 MATERIALS AND METHODS

5.1 Study design

The study was a retrospective case series

5.2 Study setting

The study was carried out at City Eye Hospital, a specialized private tertiary eye center in Kenya with ophthalmology specialists including retina surgeons. It is located in the Upper Hill area of Nairobi, 3.5 kilometers west of Nairobi central business district. The population served includes patients from the Nairobi metropolitan area and the surrounding counties. Patients are also referred from other counties for specialized retina surgeries. The area served proportionally has the largest burden of eye disease especially caused by non-communicable diseases such as hypertension and diabetes. Consequently, the facility has a constant flow of patients with VH and has scheduled surgery days. Some of the procedures done at this center include; cataract surgery, glaucoma surgery and retina surgery, including PPV.

5.3 Study Population

Patients with the diagnosis of vitreous hemorrhage that had PPV done at City Eye Hospital between 1st January 2019 to 31st December 2020 and followed up for a period not less than 3 months.

5.3.1 Inclusion criteria

All Patients with vitreous hemorrhage who underwent PPV at City Eye Hospital between 1st January 2019 to 31st December 2020 and followed up for at least 3 months.

5.3.2 Exclusion criterion

Patients whose records indicate that they were followed up for less than 3 months after PPV, or have missing data

5.4 Sample Size

The census method of sampling was used where all patients that had PPV for VH in 2019-2020 at City Eye hospital will be included in the study.

5.5 Materials

Preoperative, intra-operative and postoperative records of patients that had PPV for VH done at the center over the study period were retrieved. The records of bio-data such as the inpatient number, age, and duration of VH before surgery were recorded. First, the patient details were retrieved from the theater records where all surgeries are recorded. The files of patients that had PPV to drain vitreous hemorrhage were traced using the file numbers obtained from the theater list. Untraceable files were noted. A structured questionnaire was used to enter details of patients, and this data was used for analysis.

5.6 Sampling and Recruitment

The files of all patients with VH that had pars PPV done at City Eye Hospital between 1st January 2019 to 31st December 2020 and followed up for a period not less than 3 months were selected. Files of patients that had a secondary procedure during the PPV will also have their data collected.

5.7 Data Collection Procedures

Theater list records for patients that were operated at City Eye during the study period were scrutinized and details of patients that had PPV recorded. The file numbers of patients that had PPV for VH were recorded and followed up in the records department. These files were subjected to the data collection tool and the resultant data analyzed. The data collected from these files include the date of surgery, the visual acuity before surgery, intra-operative complications, visual acuity after surgery and the resultant complications.

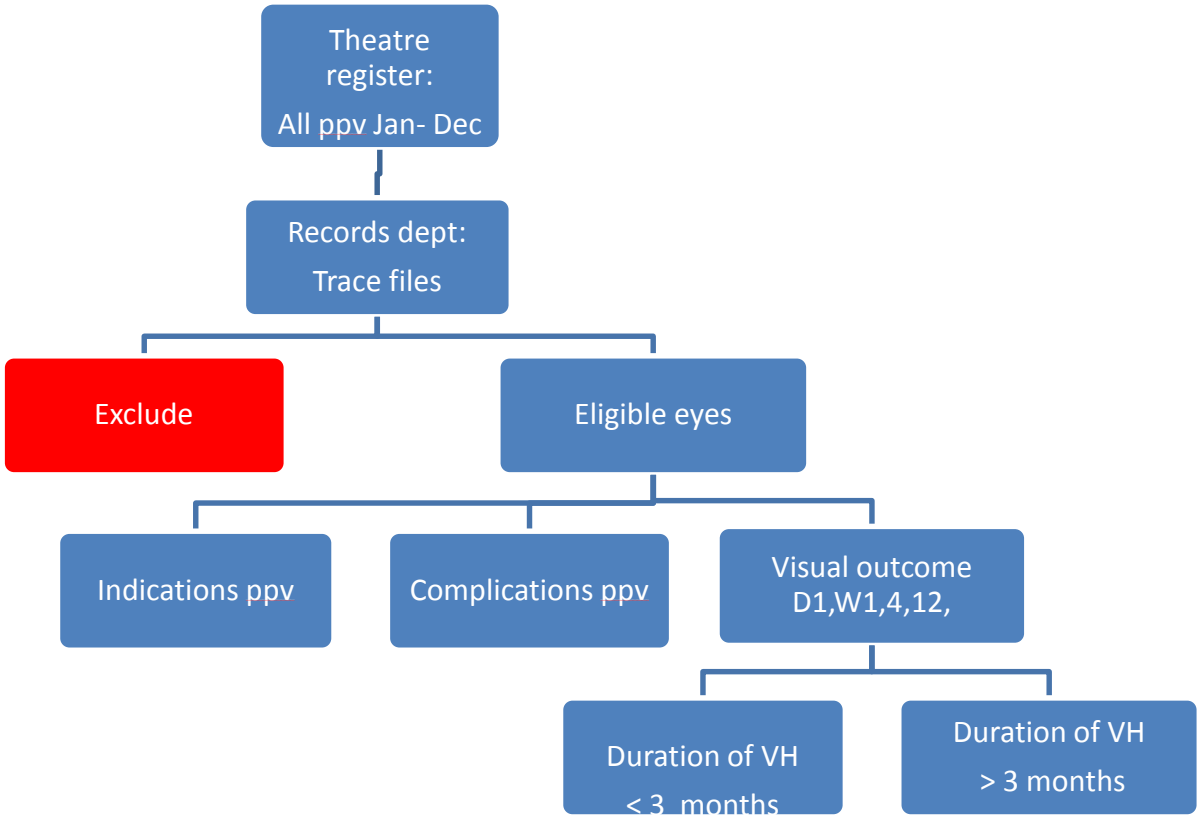


Figure 1: Conceptual framework

5.8 Data Management and Analysis

Data collected for this study was input into a computer and coded with a back-up copy being created. Analysis commenced using the latest version of SPSS. Tests of significance were utilized to compare preoperative and post-op visual acuity to establish whether PPV is useful in VH. A P-value <0.05 was considered statistically significant. Frequencies were derived with graphs and tables being used to present the variables. The results of this analysis were used to make appropriate inferences in relation to the study objectives.

5.9 Ethical Considerations

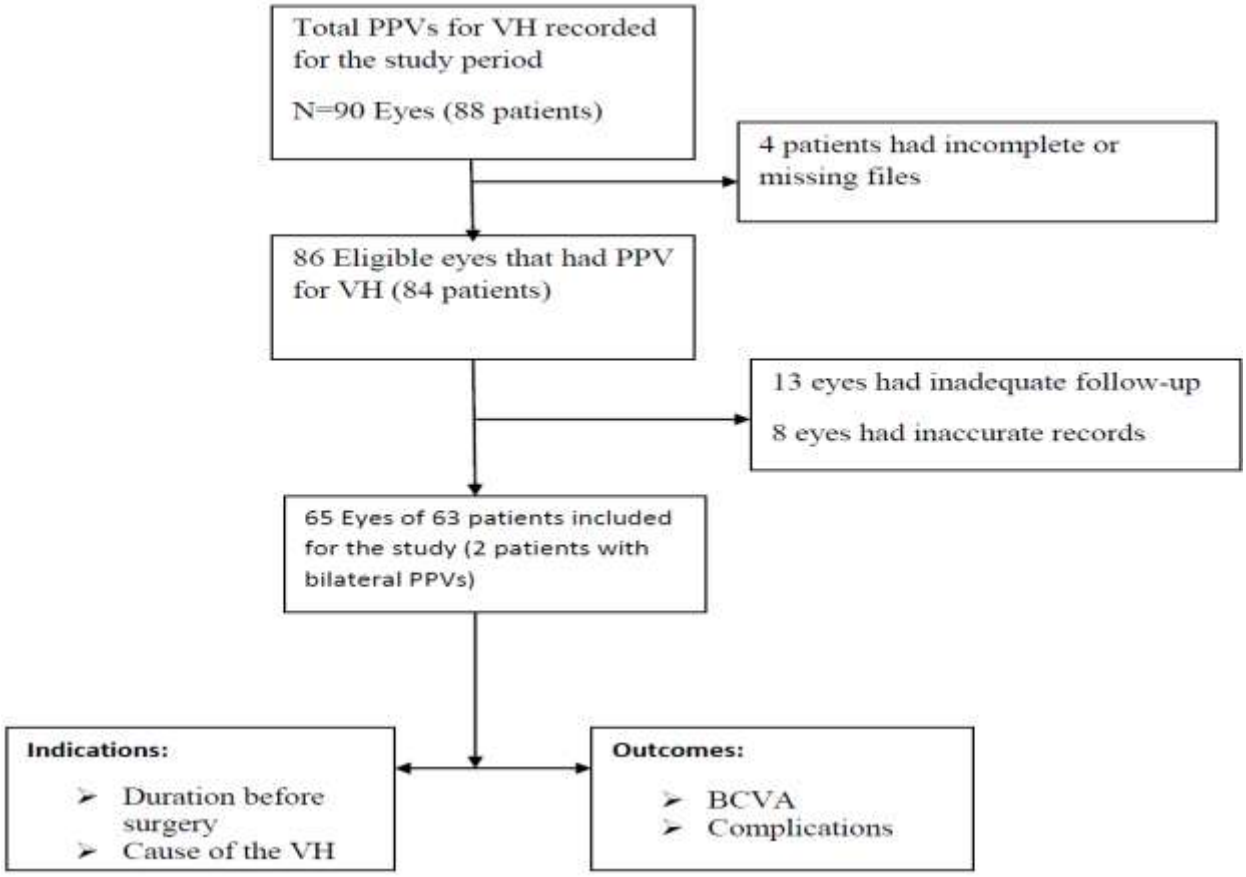
Approval to undertake the study was sought from Kenyatta National Hospital- University of Nairobi Ethics and Research Committee. The study also required approval from City Eye Hospital. The identity of patients and their identifiers were kept anonymous at all times by the use of coded data collection form. Data was stored in one computer and protected with password to facilitate confidentiality.

5.10. Study Limitations

The main limitation anticipated in the study was the absence of complete patient details in the filing system.

6 RESULTS

Figure 6.1: Study flow chart



During the duration of the study, records indicated that 88 patients (90 eyes) had PPV whose primary indication was the presence of Vitreous hemorrhage. 86 eyes were eligible; 4 files were either missing or their details did not match the file number. 13 of these patients had post-operative follow-up of less than three months and were ineligible for the study. 8 eyes had other conditions other than VH as their indication for PPV (6 had macula hole surgery only, 1 patient found to have synchisis, 1 had incomplete details). Eyes that were finally eligible for the study after the exclusion criteria were 65 (belonging to 63 patients).

6.1.1Socio-Demographic Characteristics

The mean age was 54.9 (SD 16.2) years, where the minimum observed age was 19.0 years and the maximum was 91.0 years. The median age was 56.0 (IQR 45.0 – 65.0) years. There were 25 (39.7%) female and 38 (60.3%) male patients that had PPV for VH with a female to male ratio of 1: 1.5. Most of the patients were above 50 years (68.2%). Parsplana vitrectomy was done on 37(56.9%) left eyes compared to only 28 (43.1%) right eyes.

Table 1: Patient characteristics

	Number of eyes *(n=65eyes)*	**Percent (%)**
Gender		
Male	38	60.3
Female	25	39.7
Age		
≤30	7	11.1
31 – 40	5	7.9
41 ─50	7	11.1
51─ 60	14	22.2
61 – 70	21	33.4
>70	9	14.3

Table 2: Eye that was operated

	Number of eyes (*n*=65)	**Percent (%)**
RE	28	43.1
LE	37	56.9

6.1.2 Systemic Illnesses in Patients

Majority of the patients had diabetes (78.5%), hypertension (52.4%) or a combination of both illnesses (57.1%). Only 11 patients (17.5%) did not have diabetes or hypertension with the rest (82.5%) having any of the two illnesses. The other systemic illnesses observed included renal disease 5(7.9%) and thrombocytopenia in 1(1.6%) patient.

Table 3: Systemic illnesses recorded in operated patients

Systemic Illness	Patients (*n*=63pts)	Percent (%)
Diabetes	51	78.5
Hypertension	33	52.4
DM/HTN	36	57.1
DM or HTN or Both	52	82.5
Thrombocytopenia	1	1.6
Renal disease	5	7.9

DM=Diabetes Mellitus HTN=Hypertension

6.1.3 Preoperative anterior segment findings

Majority of the eyes included in the study had an anterior segment diagnosis (64.6%) with 23 eyes (35.4%) having normal anterior segment examination. Lens related findings (36 eyes) constituted most of the anterior segment findings (55.4%). Other eye conditions observed preoperatively included; blepharitis in 2(3.2%) eyes, corneal scar in 1(1.5%) eye, corneal dystrophy in 1(1.5%) eye, neovascular glaucoma in 1(1.5%) eye, and uveitis in1(1.5%) eye.

Table 4: Anterior segment Diagnosis

	Eyes *(n=65)*	**Percent (%)**
Normal	23	35.4
Cataract	21	32.3
Pseudophakia	15	23.1
Blepharitis	2	3.2
Corneal Scar	1	1.5
Dysrotphy	1	1.5
Neovascular glaucoma	1	1.5
Uveitis	1	1.5

6.2 Indications for PPV in Operated patients with VH

6.2.1 Non-clearing vitreous hemorrhage

The main indication for surgery was non-clearing vitreous hemorrhage. 49 patients (75.4%) had surgery done more than 3 months after the onset of VH compared to 16 patients (24.66%) that had surgery done within 3 months. More than half the patients (50.8%) were first seen at the facility 3 months after the onset of visual reduction due to vitreous hemorrhage. The care giver also opted to delay PPV in 38 patients (58.5%) while either offering other modes of treatment (therapeutic delay) or due to patient factors.

Table 5: Timing of PPV earlier of less than three months

	Number of eyes ***(n=65)***	Percent (%)
Delay		
Early (<3 months)	16	24.6
Late (>3 months)	49	75.4
Type of Delay (<3months)		
Therapeutic delay	38	58.5
Delay to seek treatment	33	50.8

6.2.2 Preoperative vision

In preoperative visual assessment, 59(90.7%) eyes had a BCVA of 6/60 or less (CF, HM, and PL) with only 6(9.3%) eyes having vision better than 6/60. This finding corresponds to the density of vitreous hemorrhage observed before theater, with 47(72.3%) eyes listed as having very dense VH compared to 18(27.7%). None of the operated patients had preoperative BCVA better than 6/18

Table 6: Preoperative vision

	Number of eyes ***(n=65)***	Percent
6/18	1	1.5
6/24	3	4.6
6/36	2	3.1
6/60	9	13.8
CF	18	27.7
HM	27	41.5
PL	5	7.7

CF=counting fingers HM=hand movement PL= perception to light

Table 7: Preoperative classification of VH (Mild or Dense)

Consistency	Number of eyes ***(n=65)***	Percent (%)
Dense	47	72.3
Mild	18	27.7

6.3 Causes of Vitreous hemorrhage

The commonest cause of VH in the study was PDR (50 eyes) accounting for 76.9% of all the eyes that had vitrectomy done. Other documented causes of VH in this study included CRVO 4(6.1%), BRVO 3(4.6%), trauma 2(3.1%), Eale's disease 1(1.5%), and wet AMD 1(1.5%). Additionally, 4(6.2%) eyes had no documented cause of the vitreous hemorrhage.

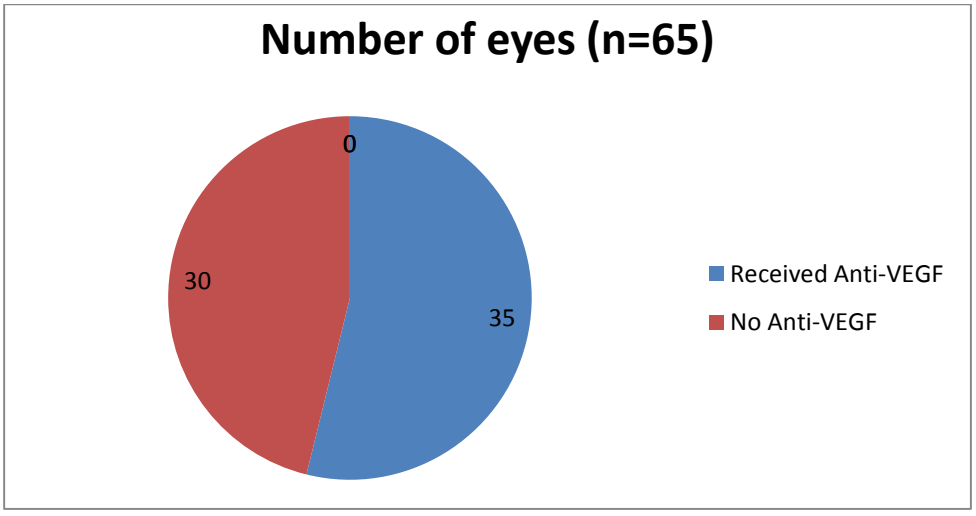
Table 9: Cause VH

	Number of eyes *(n=65)*	**Percent (%)**
PDR	50	76.9
Unknown	4	6.2
CRVO	4	6.1
BRVO	3	4.6
Trauma	2	3.1
EALES	1	1.5
AMD	1	1.5

Intravitreal Avastin

More than half the eyes (53.8%) had intravitreal injection of Anti-VEGF 3-5 days prior to surgery.

Figure 6.3: Eyes that received Anti-VEGF 3-5 days before surgery

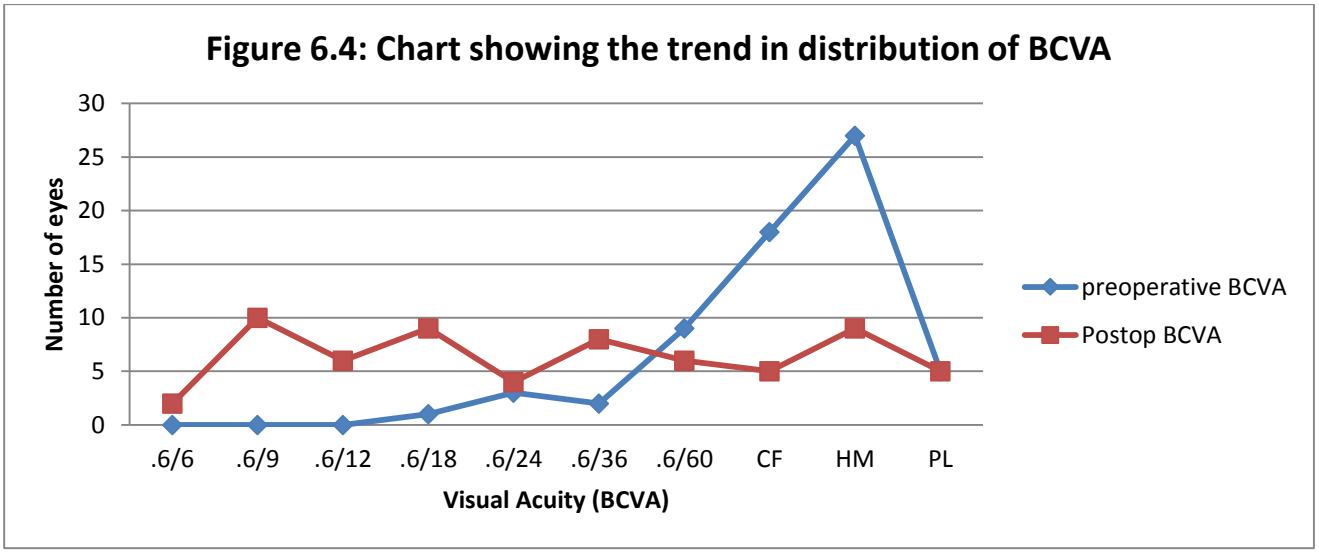


6.4 Main Outcome: Postoperative Best Corrected Visual Acuity

The main measure of outcome in this study was the BCVA. Eyes that had BCVA of 6/60 or worse preoperatively (90.7%) improved significantly with their proportion reducing to 38.4% (25 eyes); a change of 52.3%. The number of eyes that had preoperative BCVA of HM reduced significantly from 27(41.5%) to 9(13.8%), with CF reducing from 18(27.7%) eyes to 5(7.7%) eyes. There was a corresponding increase in eyes with BVCA of 6/6 (0% - 3.1%), 6/9 (0% - 15.4%), 6/12 (0% - 9.2%) and 6/18 (1.5% - 13.8%) vision.

Table 10: Preoperative vision compared to Final BCVA

Eyes ***(n=65)***	Initial BCVA (%)	Final BCVA (%)
6/6	0 (0)	2 (3.1%)
6/9	0 (0)	10(15.4%)
6/12	0 (0)	6(9.2%)
6/18	1(1.5)	9(13.8%)
6/24	3 (4.6)	4(6.2%)
6/36	2(3.1)	8(12.3%)
6/60	9(13.8)	6(9.2%)
CF	18(27.7)	5(7.7%)
HM	27(41.5)	9(13.8%)
PL	5(7.7)	5(7.7%)



6.4.1 Magnitude of BCVA change from Baseline/Preoperative vision

The final BCVA outcome was compared to baseline BCVA (vision before PPV) and categorized into; improved, unchanged, or worse. There was improvement in BCVA in 45(69.2%) eyes, 13(20%) eyes remained unchanged, while 7(10.8%) eyes had comparatively worse visual outcome. Improvement in vision was marked in patients that had severe visual reduction (≤6/60) before surgery (Table 12).

Table11. Categories of BCVA change from baseline

Preoperative BCVA	Worse Final BCVA N (%)	Unchanged final BCVA (%)	Improved final BCVA (%)
PL	0	1(20)	4(80)
CF	0	4(22.2)	14(77.8)
HM	3(11.1)	6(22.2)	18(66.7)
6/60	3(33.3)	1(11.1)	5(55.5)
6/36	0	1(50)	1(50)
≥6/24	1(25)	0	3(75)
Total Change (n =65)	7(10.8)	13(20)	45(69.2)

Figure 6.5: BCVA change from baseline

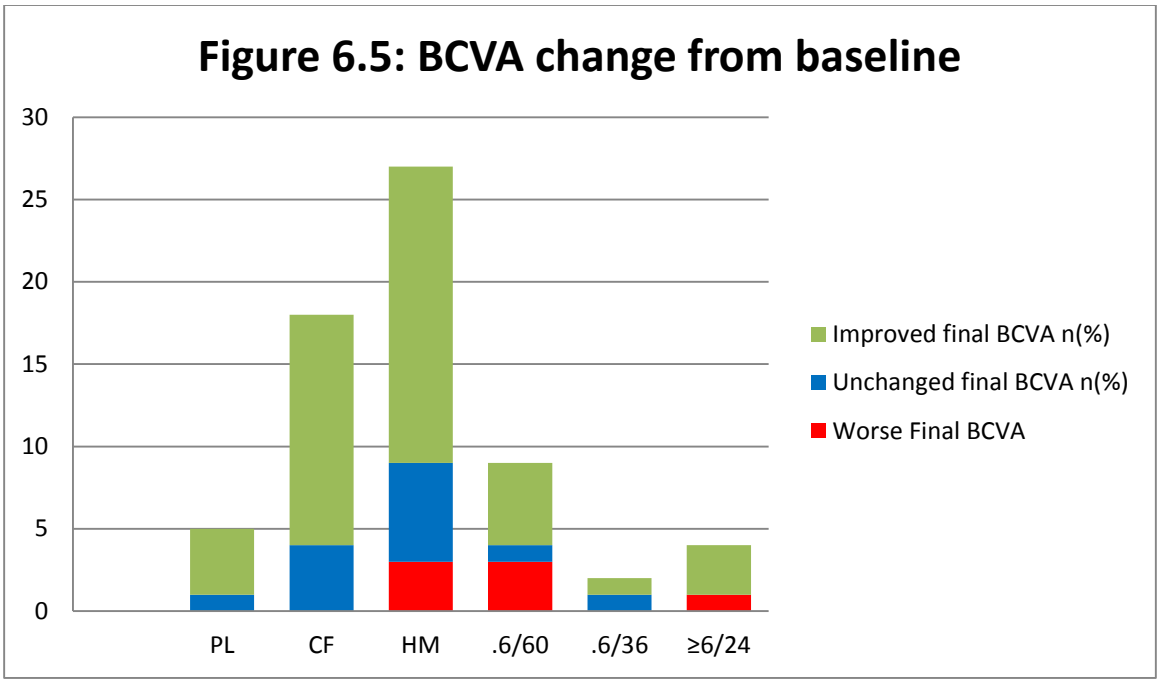
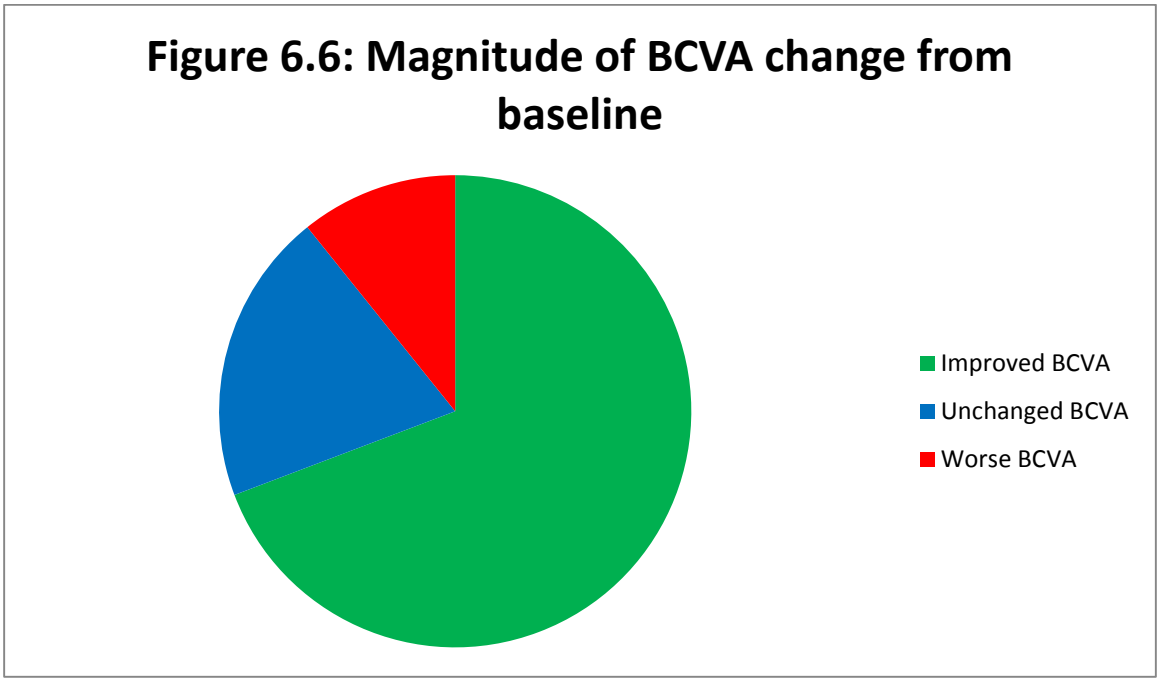


Figure 6.6: Magnitude of BCVA change from baseline



6.4.2 Factors affecting BCVA Outcomes

Several factors were assessed to establish their relationship with the post-operative BCVA including the gender, timing of PPV, preoperative intravitreal Anti-VEGF, and the consistency of vitreous hemorrhage. Gender had no significant influence on the final BCVA (P = 0.292). The timing of PPV for VH was not found to be significant in this study (P = 0.665) hence there was no visual benefit of delaying the surgery or doing it before 3 months. Although patients with dense vitreous hemorrhage had better visual improvement post PPV, this change was not statistically significant (P = 0.617). Preoperative Anti-VEGF did not influence the visual outcome (P = 0.461) (Table 13).

Table 12: Patient and surgical characteristics in relation to BCVA change

Characteristic	Worse BCVA	Unchanged BCVA	Improved BCVA	*p* Value
Gender: M/F	¾	10/3	27/18	0.292
Early PPV/Delayed PPV	2/5	2/11	12/33	0.665
Mild VH/Dense VH	¾	3/10	12/33	0.617
Preop Anti-VEGF Yes/No	4/3	5/8	26/19	0.461

6.5 Secondary Outcomes: Complications

The commonest complication encountered during and after PPV for VH in this study was rebleeding that occurred in 7(10.8%) eyes. Other complications included cataract in 4(6.2%) eyes, optic atrophy in 4(6.2%) eyes, retinal detachment in 4(6.2%) eyes, and high intraocular pressure in 4(6.2%) eyes. Neovascular glaucoma (NVG) and Hyphema occurred in one eye each. Majority of the eyes 43(66.2%), however, did not have any documented postoperative complications (Table 14).

Table 13: Distribution of complications

Complications	Number of eyes (n=65)	Percent (%)
Rebleeding	7	10.8
Cataract	4	6.2
High IOPs	4	6.2
Optic Atrophy	4	6.2
Retinal detachment	4	6.2
NVG	1	1.5
Hyphema	1	1.5
No Complication	43	66.2

6.5.1 Risk of developing complications during and after PPV for VH

There was no patient or surgical factors that significantly affected the development of intra-operative or postoperative complications during PPV (Table 15). Factors analyzed included the patients gender (P=0.772), the timing of PPV (P=0.116), consistency of the vitreous hemorrhage (mild or dense) (P=0.957), and the preoperative anti-VEGF (P=0.656).

Table 14: Risk of developing complications during and after PPV for VH

Characteristic	**Risk of complications**		***P*-value**
	Yes	**No**	
Gender: Male/Female	13/9	27/16	0.772
Timing : Early PPV/Delayed PPV	8/14	8/35	0.116
Consistency: Mild VH/Dense VH	6/16	12/31	0.957
Preop Anti-VEGF: Yes/No	11/11	24/19	0.656

6.5.2 Effects of complications on final BCVA

The presence of any complication in the operated eye significantly affected the final visual outcome (P=0.002). Complications that significantly affected the final BCVA included the development of high intraocular pressures or optic atrophy postoperatively (P=0.008), and the development of retinal detachment (P=0.009). Although patients that had rebleeding had poorer visual outcome, rebleeding did not have a statistically significant effect on the overall change in the BCVA (*P*=0.551). Cataract formation post PPV was also not statistically significant in affecting final BCVA (P=0.507) but affected the final achieved vision (Table 16).

Table 15: Relationship between complications and visual outcome

Complications		**Worse BCVA**	**Unchanged BCVA**	**Improved BCVA**	***P-value***
Any complication:	***Yes/No***	6/1	6/7	10/35	**0.002**
Rebleeding:	***Yes/No***	1/6	2/11	4/41	0.551
Cataract:	***Yes/No***	1/6	0/13	3/42	0.507
High IOP/Optic Atrophy:	***Yes/No***	1/4	3/10	2/43	**0.008**
Retinal detachment:	***Yes/No***	1/6	3/10	0/45	**0.009**

7 DISCUSSION

The goal of parsplana vitrectomy in patients with vitreous hemorrhage is to restore vision by evacuating the blood and treating the underlying cause. Our analysis of the indications of surgery, the visual outcomes and complications of PPV for VH in the African setting could set the stage for further research in this area.

The mean age was 54.9 (SD 16.2) years, corresponding to the occurrence of type 2 diabetes and systemic hypertension that were found to be the underlying systemic illnesses in these patients. There was no significant gender difference, with the female: male ratio being 1:1.6 highlighting the absence of any sexual predisposition of conditions causing vitreous hemorrhage in operated patients. Most patients operated patients in this study had diabetes, hypertension, or both corresponding to the rising incidence of non-communicable diseases as causes of VH [22].

7.1 Indications of Parsplana vitrectomy

The main indication for surgery was the presence of non-clearing vitreous hemorrhage lasting more than 3 months. There was no long-term benefit between early (<3 months) and late (>3 months) PPV for VH demonstrated in this study. Significant delay in performing surgery, however, was due to the patients presenting late (58.5% of patients) with no possible option of surgery within 3 months of the development of the VH. Vitrectomy was also delayed by the ophthalmologist to allow for clearance of the blood or as they instituted other treatment modalities for the underlying causes such as Laser and anti-VEGF injections.

Regarding etiology as the indication of PPV, PDR was the commonest cause of VH (50 eyes) accounting for 76.9% of all the eyes that had vitrectomy. This finding was similar to other studies [5, 8, 21]. CRVO was a distant second as a cause of VH in this study with BRVO and trauma

coming third and fourth respectively. Few previous studies had listed vascular occlusions (BRVO) as the commonest finding in patients that had PPV for VH [15].

7.2 Visual Outcomes

7.2.1 Baseline BCVA

In this study, eyes with lower baseline BCVA (HM, Counting fingers, and <6/60) had the most benefit from PPV. Most of the previous studies reviewed were in agreement, showing greater visual improvement if the presenting vision was low [5,8,9,15,21]. Although eyes that had baseline BCVA greater than 6/60 were few in this study, their progressive improvement was less significant. There was a general improvement in vision after PPV for VH.

7.2.2 Factors affecting BCVA Outcomes

All the factors assessed had no effect on the vision achieved after PPV. The patients' gender and consistency of the VH were consequently insignificant in their effect on visual outcomes. Although previous studies showed improved visual outcomes with early PPVs [16], this current review did not demonstrate any benefit. Delayed treatment, however, was mostly not the decision of the ophthalmologist as the patients presented late. The use of preoperative anti-VEGF was also not significant in its effects on visual outcomes (P=0.665). Few studies look at the effect of preoperative anti-VEGF and the vision post PPV [24].

7.3 Complications

Most of the operated eyes (66.2%) did not develop any complications in theater or after PPV. Rebleeding occurred in 10.8% of surgeries and was the commonest complication encountered during and after PPV for VH and this finding was consistent with other studies [22]. Other complications encountered included cataracts, optic atrophy, retinal detachment, high intraocular pressure, neovascular glaucoma (NVG), and hyphema. These complications were also encountered in most of the other studies reviewed [8,9,16, 24]. The development of complications was not affected by gender, timing of surgery, or the consistency of the VH. Some studies show a reduced occurrence of rebleeding post PPV when patients had preoperative intravitreal anti-VEGF [24], but this was not demonstrated in the current study.

Patients that developed complications during or after surgery had poorer final BCVA compared to those that had no complications, and this was statistically significant (P=0.002). High intraocular pressures and optic atrophy also resulted in poorer BCVA, but rebleeding did not significantly affect vision. Cataract formation post PPV was also not statistically significant in affecting final BCVA (P=0.507) but affected the final achieved vision.

7.4 Compatibility with other studies

The findings are largely compatible with other studies. Similar findings include that PDR was the commonest cause of VH as stated in most of the studies. Additionally, the timing of surgery was not an important indicator of visual outcome or the risk of developing complications. Studies that showed reduction of rebleeds during and after PPV with the use of preoperative anti-VEGF predominantly enlisted patients with PDR only.

7.5 Study limitations

The recording of visual acuity did not use the log Mar system which is a more standardized method of visual acquisition. Additionally, the follow-up period of 3 months was relatively short compared to some studies that followed up patients for even a year. Long-term complications were not, therefore, effectively captured. Enlisting patients before theater would have been a better way of determining the indications for PPV by discussing why some patients went to theater and others did not. The sample size was also relatively small.

8: CONCLUSIONS

The commonest cause of vitreous hemorrhage in patients that needed pars plana vitrectomy was proliferative diabetic retinopathy (76.9%).

The duration of vitreous hemorrhage as an indication of PPV did not have any bearing on the visual outcome.

Most patients needing surgery to clear vitreous hemorrhage had diabetes and hypertension as systemic illnesses.

There was a significant improvement in best corrected visual acuity in patients that had PPV to evacuate vitreous hemorrhage

The commonest complication encountered during and after surgery was rebleeding (10.8%) but most of the surgeries were uneventful with no post-op complications.

9 Recommendations

Patients with PDR should be closely followed up and treated to prevent them developing vitreous hemorrhage necessitating PPV.

Intraocular pressure after PPV should be closely monitored and managed early to prevent secondary glaucoma and poor visual outcomes

There is need for further studies to establish the relationship between preop intravitreal anti-VEGF and visual outcomes post PPV for VH in the local setting.

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11 Appendices

11.1 Data Collection Form

Serial No ……. Hospital No……. Date of presentation…… Date of PPV……..

Age…….. Sex: ☐

Duration of VH before date of presentation (weeks)…….

Duration of VH before Surgery (weeks)…… **Early** (<3 months)…….**Late** (>3 months)….

Systemic illness (specify)……

Pre-operative assessment

	Right Eye	Left Eye
BCVA (recorded VA)		
IOP		
Ant Segment Diagnosis		
VH mild or Dense?		
Posterior segment Findings		
B-Scan Findings		
Cause of VH (specify		
Preop Anti VEGF given?		
Diagnosis		
Other remarks		

Eye with VH that underwent PPV (tick one)

Intraop complications during PPV for VH

	Which Eye with VH underwent PPV? **Right Eye**…….**Left Eye**…….
Complication	
0 (None)	

Post-op Visual outcome of eye that underwent PPV

Duration post PPV	Vision RE	Vision LE
Day1		
Week 1		
Week 4		
Week 12		

Post-op complications …….

11. 2 Budget

No	**Item**	**Description**	**Quantity**	**Unit Cost**	**Total cost**
Proposal |Costs					
1	Stationery	Printing	500 pages	20	10,000
2		Binding	15 copies	40	600
3		Final copy Bind			5,000
4	Research subscription and internet				5,000
5	Ethics proposal cost			2000	2000
Subtotal					**22,600**
Data Collection					
6	Transport	1 month			30,000
7	Communication	Credit			1,000
8	Personnel	Research Assistant	1 month	2500 daily	75,000
9		Statistician		80,000	80,000
10		Records personnel		1,000 daily	30,000
11	Institutional approval-KNH/City Eye			2,000	4,500
12	Contingency/results dissemination				10,000
13	**Sub-Total**				**230,500**
14	**Cumulative Total**				**253,100**

11.3: Ethical Approval

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7th February, 2022

Dr. Edwin Kamau Mbugua
Reg. No. H58/7204/2017
Dept. of Ophthalmology
Faculty of Health Science
University of Nairobi

07 FEB 2022

Dear Dr. Mbugua,

RESEARCH PROPOSAL: A REVIEW OF THE INDICATIONS, OUTCOMES AND COMPLICATIONS OF PARS PLANA VITRECTOMY FOR VITREOUS HEMORRHAGE AT AN URBAN EYE HOSPITAL IN NAIROBI, KENYA (P829/10/2021)

This is to inform you that KNH-UoN ERC has reviewed and approved your above research proposal. Your application approval number is **P829/10/2021.** The approval period is 7th February 2022 – 6th February 2023.

This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by KNH-UoN ERC.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to KNH-UoN ERC 72 hours of notification.
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH-UoN ERC within 72 hours.
v. Clearance for export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days upon completion of the study to KNH-UoN ERC.

Protect to discover

11.4 Turnitin Report

Turnitin Originality Report

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