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VISUAL AND ANATOMICAL OUTCOMES OF COMBINED PHACOVITRECTOMY VS VITRECTOMY ALONE

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Abstract

Objective: *To compare the postoperative BCVA at various intervals between the Phacovitrectomy and Vitrectomy Alone groups, examining the efficacy of each surgical approach in achieving visual acuity improvements.*

Study Setting:
Department of Ophthalmology, University Medical and Dental College, Faisalabad

Study Duration: *Aug 2024 to Feb '25*

Methodology: *Randomization was done with the help of computer and two groups were generated Group A: Combined Phacovitrectomy: Cataract surgery (phacoemulsification and intraocular lens implantation) followed by vitrectomy. Standardized surgical techniques and intraoperative measures to ensure consistency. Group B: Vitrectomy Alone: Vitrectomy performed without concomitant cataract surgery. Standardized surgical techniques and intraoperative measures to ensure consistency. Primary outcome was in terms of change in best-corrected visual acuity post-surgery at specific intervals whereas secondary outcomes include assessing anatomical outcomes. The study involves 90 cases (45 per group) with calculated power, significance level, and expected success rates.*

Results: *Demographic and clinical characteristics between the Combined (n=45) and Pars Plana Vitrectomy (PPV) groups (n=45) were compared. No significant differences in age, BCVA, or gender were observed, providing insights into baseline characteristics. Postoperatively, BCVA improvements were noted in both groups, with a significant difference favoring PPV at the final follow-up (p=0.000). The occurrence of retinal detachment showed a slight numerical difference between groups, but no significant disparity (p=0.398), indicating relatively low overall rates in both the Combined (4.4%) and PPV (8.9%) groups.*

Conclusion: *The combined phacoemulsification and pars plana vitrectomy emerge as a safe and effective approach for treating retinal detachment, showing comparable anatomical and functional outcomes to PPV with delayed cataract surgery.*

INTRODUCTION

The co-occurrence of cataract and vitreoretinal disorders is often seen because to their heightened prevalence in older individuals. In the event that surgical intervention becomes necessary, a potential approach is to conduct sequential surgeries. Nevertheless, it is important to note that performing cataract surgery subsequent to vitrectomy in distinct surgical settings carries an elevated likelihood of complications. These complications encompass a diminished stability of the anterior chamber, reduced zonular support, heightened occurrence of posterior capsular tears, and the potential loss of nuclear fragments.[1-3] Although cataract surgery may be done before vitrectomy, doing so requires a second surgical setting and leaves patients with continuous obscured vision due to the retinal illness. In contrast to integrated treatments, sequential surgeries need two separate operations and two separate anaesthetic experiences. [4] The prevalence of significant cataract formation following vitrectomy in individuals who still retain their natural lenses, known as "phakic" eyes, is noteworthy. Within one year post-vitrectomy, approximately 75% of phakic eyes develop visually significant cataracts, a figure that escalates to 95% within a two-year timeframe.5 This heightened cataract development is attributed to the increased levels of oxygen surrounding the lens following the removal of vitreous humor, which, in turn, accelerates cataract formation.[3]

Opting for a combined cataract surgery and vitrectomy procedure offers distinct advantages, primarily centered around accelerating the recovery of a patient's vision. This approach entails a single surgical session and a solitary administration of anesthesia, making it a more streamlined and efficient process. A noteworthy aspect that drives the need for combined surgery is the observation that vitrectomy can expedite the development of cataracts. Cataracts, characterized by the clouding of the eye's natural lens, are typically associated with age-related changes in the lens's transparency. However, following vitrectomy, this clouding process can occur more rapidly, necessitating cataract surgery sooner than it would have been required under normal circumstances. As a result, patients often find themselves in a prolonged state of reduced visual potential until the cataract surgery is performed.[1]

The consequence of this accelerated cataract formation is that the improvements in vision achieved following vitrectomy are often transient. As the cataract continues to develop, patients may experience a gradual decline in their vision, coupled with a change in their refractive error, often resulting in a myopic shift related to post-vitrectomy cataracts. This evolution eventually necessitates a second surgery, namely cataract surgery, which becomes indispensable to restore clear vision. On average, this second surgical intervention takes place approximately 8.14 months following small gauge vitrectomy, with patients enduring progressive blurred vision between the vitrectomy and the cataract surgery.[6]

However, these challenges and the need for two separate surgeries can be effectively circumvented through the adoption of combined cataract and vitrectomy procedures. By addressing both cataracts and vitreoretinal issues simultaneously, patients can experience improved vision more rapidly, with fewer disruptions to their daily lives, ultimately ensuring a more seamless journey to visual recovery.[1]

While combined cataract and vitrectomy surgeries have been practiced for over three decades, there remains an ongoing debate within the medical literature regarding the potential impact of these combined procedures on refractive errors. Specifically, the question at hand is whether the refractive outcomes of combined surgery differ significantly from those of cataract surgery performed as a standalone procedure.[1]

In a study conducted by Falkner-Radler et al[7], a noteworthy discovery was made. They observed a significant degree of induced myopia, which amounted to approximately -0.4 diopters (D), in cases where combined surgery was performed. This finding prompted their recommendation for the use of slightly hyperopic intraocular lenses (IOLs) in combined surgeries to counteract this myopic shift. This myopic shift is crucial to understand because it can impact a patient's vision post-surgery, potentially necessitating further adjustments. Moreover, the study conducted by Sakamoto et al8 further

contributes to this complex issue. They investigated eyes undergoing phacovitrectomy for retinal detachment in the presence of intraocular gas. Their research led to a theory that the myopic shift observed in such cases may be attributed to a forward shift of the posterior chamber (PC) IOL. [7]

However, it is important to acknowledge that not all studies in the literature concur on this matter. Several studies have reported no significant difference in the refractive outcomes of combined surgery compared to those of cataract surgery performed as a standalone procedure.[9-12] These studies suggest that refractive errors do not necessarily vary significantly between the two approaches, dispelling some of the uncertainty surrounding the topic.

In this context, the current study aims to make a significant contribution to this body of knowledge. It presents one of the largest series of cases, providing a robust basis for comparing refractive outcomes and intraoperative complications between combined cataract surgery and vitrectomy both executed by the same anterior and posterior segment surgeons and cataract surgery as an isolated procedure, performed by the same anterior segment surgeon. The insights gained from this study could provide valuable guidance for surgeons and patients in deciding the most appropriate approach for their specific ocular conditions.

METHODOLOGY:

This study is a prospective, single-center, randomized controlled trial designed to compare the anatomical and visual outcomes of two surgical interventions for patients with specific ocular conditions. The study was conducted at the department of ophthalmology, University Medical and Dental College, Faisalabad over a period of six months from February to July, 2025. After the approval from the Institutional Review Board and CPSP (Ref No: CPSP/REU/VRO-2017-038-131, Dated: 12/02/2024). The study included all patients aged 50 years and older, the diagnosis of ocular conditions that require either vitrectomy alone or combined phacovitrectomy and those having ability to provide informed consent. Whereas the patients with contraindications to either procedure, pregnancy or lactation, and participation in other clinical trials simultaneously were excluded from the study. The eligible participants were randomly assigned to one of two treatment groups: combined phacovitrectomy or vitrectomy alone. Randomization was achieved using computer-generated random numbers, ensuring an equal distribution between the two groups. Allocation concealment is maintained throughout the trial. The nature of the surgical procedures precludes blinding of patients and surgical staff. However, outcome assessors and data analysts are blinded to the treatment group to reduce bias in the assessment of anatomical and visual outcomes. Group A: Combined Phacovitrectomy: Cataract surgery (phacoemulsification and intraocular lens implantation) followed by vitrectomy. Group B: Vitrectomy Alone: Vitrectomy performed without concomitant cataract surgery. Standardized surgical techniques and intraoperative measures to ensure consistency.

Primary Outcome: Change in best-corrected visual acuity (BCVA) from baseline to postoperative follow-up at specific time points (e.g., 1 month, and 3 months). Secondary Outcomes: Anatomical outcomes (e.g., Vitreous hemorrhage) and complication rates (e.g., intraoperative and postoperative complications). The sample size of 90 cases; 45 cases in each group, is calculated is calculated with 80% power of test, 5% level of significance and taking expected percentage of success rate as 84.3% in the combined group and 89.2% in the PPV group. The Data collection includes baseline assessments, preoperative, intraoperative, and postoperative variables, and is performed by trained research personnel. Regular follow-up examinations are conducted at predetermined intervals for each patient. Data are collected using standardized data collection forms and entered into a secure electronic database. The data analysis was conducted using appropriate statistical methods, such as chi-square tests, t-tests, or non-parametric tests as applicable, with significance set at $p < 0.05$. Subgroup analyses may be performed based on specific patient characteristics.

RESULTS:

In the preoperative phase of our study, a detailed assessment of key variables was conducted to compare outcomes between the Combined group

(n=45) and the Pars Plana Vitrectomy (PPV) group (n=45). Patient demographics revealed a mean age of 64.27±4.75 years in the Combined group, marginally higher than the PPV group's mean age of 63.84±3.99 years. However, this age difference did not reach statistical significance (p=0.649), suggesting a comparable baseline in terms of age distribution between the two groups.

Visual acuity, a crucial metric measured by Best-Corrected Visual Acuity (BCVA), exhibited mean values of 1.46±0.12 in the Combined group and 1.43±0.67 in the PPV group at baseline. This corresponds to approximately 20/600 and 20/500 on the Snellen chart, respectively. While a numerical difference in mean BCVA was noted, the p-value of 0.144 indicated that this distinction was not statistically significant. These preoperative findings underscored the need for a nuanced examination of visual and demographic variables to establish a comprehensive understanding of the patient populations before surgical interventions.

These insights into the preoperative phase are pivotal for eye surgeons as they navigate the decision-making process. The lack of significant age disparities and the non-significant numerical difference in baseline BCVA between the Combined and PPV groups suggest a comparable starting point for both surgical approaches. Surgeons may find reassurance in the similarity of these preoperative variables, informing their expectations and strategies as they proceed with either combined phacovitrectomy or vitrectomy alone for rhegmatogenous retinal detachment.

Another variable assessed was the Axis Length, measured in millimeters. The Combined group had a mean Axis Length of 24.27 mm with a standard deviation of 0.91, whereas the PPV group had a slightly higher mean of 24.64 mm with a standard deviation of 1.13. The p-value for this comparison was 0.085, suggesting a trend towards a difference, but it did not reach statistical significance. The preoperative comparison of variables between the Combined and PPV groups did not reveal statistically significant differences in age, BCVA, or Axis Length. These findings provide insights into the baseline characteristics of the study population before further interventions or treatments were administered.

In the preoperative phase of the study, the demographic and clinical characteristics of patients in the Combined group (n=45) and the PPV (Pars Plana Vitrectomy) group (n=45) were compared. No statistically significant differences were observed in gender distribution, with 77.8% males in the Combined group and 82.2% in the PPV group (p=0.598). Similarly, the prevalence of macular status "On" versus "Off" and the occurrence of vitreous hemorrhage did not show significant disparities between the two groups, with p-values of 0.827 and 0.634, respectively. These findings provide a comprehensive overview of the frequency distribution of qualitative variables in the preoperative setting, shedding light on the baseline characteristics of the study cohorts before further interventions were implemented.

The postoperative outcomes of the Combined group (n=45) and the PPV (Pars Plana Vitrectomy) group (n=45) were compared in terms of Best-Corrected Visual Acuity (BCVA) at various intervals. Initially, at baseline, the mean BCVA was 1.46 with a standard deviation of 0.12 in the Combined group and 1.43 with a standard deviation of 0.67 in the PPV group, with a non-significant difference (p=0.144). However, at the 1-month follow-up, both groups exhibited improved BCVA, with mean values of 0.71 (Combined) and 0.68 (PPV), corresponding to approximately 20/83 and 20/80 on the Snellen chart, respectively. Although the difference was not statistically significant (p=0.385), it indicated positive trends in visual acuity postoperatively. Notably, at the final follow-up, the BCVA in the Combined group further improved to a mean of 0.43 (~20/50), while the PPV group showed a more substantial improvement with a mean BCVA of 0.34 (~20/40), and this difference was statistically significant (p=0.000). These findings underscore the effectiveness of the Pars Plana Vitrectomy intervention in achieving significant visual acuity improvements during the postoperative period.

In the assessment of anatomical outcomes postoperatively, the Combined group (n=45) and the PPV (Pars Plana Vitrectomy) group (n=45) were compared with respect to the occurrence of retinal detachment. In the Combined group, 4.4% (2 individuals) experienced retinal detachment, while in the PPV group, 8.9% (4 individuals) had a similar

outcome. However, the difference in the incidence of retinal detachment between the two groups was not statistically significant, with a p-value of 0.398. The majority of patients in both groups, 95.6% in the Combined group and 91.1% in the PPV group, did not encounter retinal detachment. This suggests that while there was a slight numerical difference in the occurrence of this anatomical complication, the overall rates were relatively low, and no significant disparity was observed between the two groups in terms of retinal detachment outcomes.

TABLE 1: MEAN VARIABLES (PREOPERATIVE)

Variables	Combined group(n=45)	PPV group(n=45)	P
Age(years)	64.27±4.75	63.84±3.99	0.649
BCVA	1.46±0.12(~20/600)	1.43±0.67(~20/500)	0.144
Axis Length(mm)	24.27±0.91	24.64±1.13	0.085

TABLE 2: FREQUENCY OF QUALITATIVE VARIABLES (PREOPERATIVE)

Variables		Combined group(n=45)	PPV group(n=45)	P
Gender	Male	35(77.8%)	37(82.2%)	0.598
	Female	10(22.2%)	8(17.8%)	
Macular status	On	16(35.6%)	17(37.8%)	0.827
	Off	29(64.4%)	28(62.2%)	
Vitreous Hemorrhage	Yes	34(75.6%)	32(71.1%)	0.634
	No	11(24.4%)	13(28.9%)	

TABLE 3: COMPARISON OF BOTH GROUPS FOR BCVA(POST-OPERATIVE)

Interval	Combined group(n=45)	PPV group(n=45)	P
Baseline	1.46±0.12(~20/600)	1.43±0.67(~20/500)	0.144
1 month after	0.71±0.14(~20/83)	0.68±0.15(~20/80)	0.385
Final followup	0.43±0.09(~20/50)	0.34±0.08(~20/40)	0.000

TABLE 4: COMPARISON OF ANATOMICAL OUTCOME

Variables		Combined group(n=45)	PPV group(n=45)	P
Retinal detachment	Yes	2(4.4%)	4(8.9%)	0.398
	No	43(95.6%)	41(91.1%)	

DISCUSSION:

This study conducted an extensive examination of the preoperative and postoperative variables to compare the outcomes of combined phacovitrectomy with vitrectomy alone in the context of rhegmatogenous retinal detachment. The preoperative phase involved a meticulous analysis of various parameters between the Combined group

and the Pars Plana Vitrectomy (PPV) group, including age, visual acuity, and Axis Length. The absence of statistically significant differences in these baseline characteristics (age: p=0.649, BCVA: p=0.144, Axis Length: p=0.085) laid a solid foundation for subsequent analyses, ensuring a comprehensive understanding of the study population's characteristics before surgical interventions.

Moving to the postoperative outcomes, the study revealed positive trends in visual acuity improvement for both groups. Notably, while the difference at the 1-month follow-up was not statistically significant (p=0.385), the final follow-up demonstrated a significant improvement in the PPV group compared to the Combined group (p=0.000). This emphasized the effectiveness of Pars Plana Vitrectomy in achieving substantial visual acuity improvements during the postoperative period.

Anatomical outcomes were also explored, particularly the occurrence of retinal detachment. The study found low rates overall, with no significant disparity between the Combined and PPV groups (p=0.398). This indicated the safety and effectiveness of both surgical approaches in achieving favorable anatomical outcomes. Comparisons with Irfan Muslim's study [13] introduced some discrepancies, particularly in short-term visual outcomes, emphasizing the importance of considering variations in study design and patient populations when interpreting results. The findings aligned with Alexa Tan's study [14] in terms of anatomical success rates but deviated from the observed myopic shift associated with combined cataract extraction.

Analyzing Young Gu's study [15] provided valuable insights into the nuanced interpretation of results. Their study suggested a significant anatomical difference in favor of combined phacovitrectomy. However, our findings did not align with this observation, underscoring the complexity of comparing outcomes across different studies. Factors such as sample sizes, surgical techniques, and follow-up durations likely contributed to these variations. The inclusion of Guber et al.'s substantial dataset [16] further enriched the comparative analysis, focusing on redetachment rates. Their observation of no significant difference in the rate of re-detachment when additional phacoemulsification was performed adds a valuable perspective to our study.

This consistency in outcomes across studies strengthens the argument for the comparable anatomical results of combined phacovitrectomy and vitrectomy alone. Guber et al.'s data, [16] involving 1017 eyes, provided a substantial dataset that corroborated our findings, revealing that additional phacoemulsification did not significantly impact the rate of re-detachment ($p > 0.05$). Notably, the results contradicted Irfan Muslim's study, where no re-detachment occurred during follow-ups. The congruence in outcomes across these studies underscores the robustness of the evidence suggesting comparable anatomical results irrespective of the surgical approach.

CONCLUSION:

This detailed analysis of preoperative and postoperative variables, along with comparisons with other relevant studies, provides a nuanced understanding of the outcomes associated with different surgical approaches for retinal detachment. It highlights the need for careful consideration of various factors that may influence outcomes, including variations in study design, surgical techniques, and follow-up durations. The consistent findings across studies strengthen the argument for the comparable anatomical results of combined phacovitrectomy and vitrectomy alone, emphasizing the importance of evidence-based decision-making in the clinical management of retinal detachment. Further research, incorporating larger sample sizes and standardized methodologies, will contribute to refining our understanding of the comparative effectiveness of these surgical approaches.

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