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Original Article

Clinical efficacy of Conbercept combined with pars plana vitrectomy for proliferative diabetic retinopathy

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Abstract: Objective: To evaluate the clinical efficacy of Conbercept combined with pars plana vitrectomy (PPV) in patients with proliferative diabetic retinopathy (PDR). Methods: A total of 118 PDR patients were retrospectively selected and allocated to a control group (n=52, undergoing PPV only) and an observation group (n=66, receiving preoperative intravitreal Conbercept combined with PPV) according their treatment regimen. Outcome measures included visual acuity improvement, best-corrected visual acuity (BCVA), central retinal thickness (CRT), intraocular pressure (IOP), surgical indices (intraoperative electrocautery frequency, eyes with intraoperative bleeding, silicone oil usage, and iatrogenic retinal injury), preoperative aqueous humor cytokine levels, postoperative complications, and life quality. Results: Postoperative visual acuity was notably better in the observation group compared with the control group. Both groups showed significant reductions in BCVA, CRT, and IOP after surgery, with the observation group displaying even lower values. Intraoperative electrocautery frequency, eyes with bleeding, silicone oil usage, incidence of iatrogenic retinal injury, and preoperative aqueous humor cytokine levels were lower in the observation group compared with the control group. Moreover, the observation group also reported a lower overall complication rate and better postoperative quality of life. Conclusion: Preoperative intravitreal Conbercept combined with PPV offers superior clinical benefits for PDR patients.

Keywords: Conbercept, vitrectomy, proliferative diabetic retinopathy, therapeutic outcomes, postoperative complications

Introduction

In the United States, nearly 40 million individuals suffer from diabetes, a condition accompanied by a high risk of serious macrovascular and microvascular complications [1]. Diabetic retinopathy (DR), as a common microvascular complication, is characterized by hyperglycemia-induced neurovascular degeneration and primarily manifests as abnormal neovascularization in the optic disc or other retinal regions [2]. DR can be divided into non-proliferative DR (NPDR) and proliferative diabetic retinopathy (PDR). NPDR is mainly featured by microvascular changes in the retina without the formation of preretinal neovascularization [3]. PDR, a more severe form, is accompanied by epiretinal neovascularization or angiogenesis in other ocular regions, posing a threat to vision and potentially leading to blindness [4, 5].

Therapies for PDR mainly include pars plana vitrectomy (PPV) and intravitreal injections of anti-vascular endothelial growth factor (VEGF) agents [6]. Among them, PPV mainly solves the abnormal traction of vitreous-related retinas by removing the vitreous humor, hematocele, and inflammatory substances in patients' eyes, thus helping to restore visual function [7]. Early PPV intervention for vitreous hemorrhage secondary to PDR is conducive to improving visual outcomes and reducing the risk of severe complications, thereby contributing to long-term visual benefits [8].

Conbercept, an anti-VEGF agent, is administered intravitreally prior to PPV to prevent abnormal neovascularization and vascular leakage, which helps to reduce surgical difficulty and improve postoperative outcomes [9]. In PDR, Conbercept regulates inflammatory pathways

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(e.g., phosphorylated nuclear factor-kappa B inhibitor alpha [p-IKBα] and phosphorylated nuclear factor-kappa B p65 subunit [p-p65]), to suppress angiogenesis, inflammation, and oxidative stress [10]. A meta-analysis reported that, compared with PPV alone, anti-VEGF drugs combined with PPV significantly improve visual acuity at 3 months postoperatively [11]. However, detailed analysis specifically investigating the clinical effects of Conbercept in combination with PPV for PDR remain limited. Therefore, the present study was conducted to comprehensively investigate the clinical advantages of this combination.

Materials and methods

Patient cohort

This retrospective study included 118 PDR patients, admitted to Tianjing Eye Hospital from April 2022 to April 2025, according to predefined inclusion and exclusion criteria. Among them, 52 cases in the control group received PPV alone, while 66 patients in the observation group received preoperative Conbercept followed by PPV. This study was approved by the Ethics Committee of Tianjin Eye Hospital.

Inclusion criteria: confirmed PDR diagnosis [12] and PPV treatment at our institution; monocular disease; presence of neovascular membranes involving the macula or causing localized tractional retinal detachment; non-macular neovascularization associated with preretinal hemorrhage or dense vitreous hemorrhage for more than 3-4 weeks; tractional macular edema; severe fibrovascular proliferation; and complete clinical data available. Exclusion criteria: contraindications to surgery; history of intraocular surgery; pregnancy or lactation; known medication allergies; thyroid-associated ophthalmopathy; severe vital organ insufficiency; coagulation abnormalities; inadequate fundus visualization; or previous intravitreal anti-VEGF therapy.

Sample size estimation

The primary endpoint was the best-corrected visual acuity (BCVA, logMAR) at postoperative 6 months. Sample size estimation was based on a two-sample comparison of means formula, with alpha error set at 0.05 (two-tailed) and statistical power (1-β) at 0.80. According to previous literature, the minimum clinically significant difference was set at 0.15 logMAR [13], and the expected pooled standard deviation was 0.25. According to the calculation, each group required at least 44 patients. The actual enrollment (52 cases in the control group and 66 cases in the observation group) exceeded this minimum requirement.

Post-hoc power analysis showed a statistical power exceeding 99% for BCVA at postoperative 6 months, based on the observed effect size (Cohen's d=1.22, α=0.05), far higher than the conventional 80% threshold, thereby fully meeting the statistical power requirements.

Treatment protocols

Patients in the control group received PPV alone, while patients in the observation group received preoperative intravitreal Conbercept injection in additional to PPV. Preoperatively, all patients underwent comprehensive ocular examinations, including visual acuity testing, A/B-scan ultrasonography, fundus fluorescein angiography, and optical coherence tomography (OCT). Topical levofloxacin eye drops were administered to the operated eye 4 times daily for three days prior to surgery for prophylactic purposes. All participants underwent routine pupil dilation to 5-6 mm before the procedure. All surgeries were performed by a single experienced surgical team.

Intravitreal Conbercept injection procedure: The patient was positioned supine. After routine disinfection and local anesthesia, a pars plana puncture was performed, and Conbercept (0.05 mL) was slowly injected into the vitreous cavity. Post-injection, tobramycin-dexamethasone eye drops were prescribed four times daily for three consecutive days. A conventional 25-gauge, three-port PPV was subsequently performed.

PPV and aqueous humor sample collection: After aseptic draping and disinfection, retrobulbar nerve block anesthesia was performed to establish a scleral channel. An anterior chamber paracentesis was performed at the 2:30 o'clock limbal position to collect undiluted aqueous humor (0.15-0.2 mL). Subsequently, a high-speed vitreous cutter was used to completely remove vitreous hemorrhage or organized vitreous body from the anterior and posterior regions, as well as the vitreous base at 2,500 r per minute. Next, the proliferative membrane of the retinal microvessels was stripped off, relieving the traction on the retina

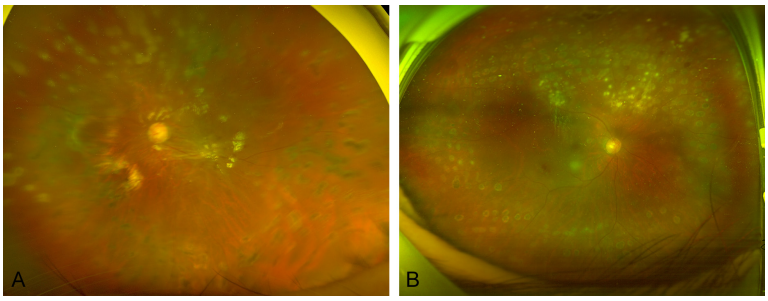

Figure 1. Representative fundus photographs of the observation group before and after the surgery. A. Preoperative fundus photograph showing tortuous retinal neovascularization accompanied by extensive hemorrhage and a disordered fundus structure. B. Postoperative fundus photograph displaying regression of neovascularization, absorption of hemorrhage, and visible laser photocoagulation spots, with a more organized and stabilized fundus structure.

and allowing the retina to return to its original position. Electrocoagulation was performed on the active bleeding points, followed by full retinal photocoagulation using a 532-nm laser (spot size: 200-500 μm, exposure time: 0.1-0.3 seconds, exposure intensity: light spot of 2-3 levels). If a tear or edema in the retina prevented adequate photocoagulation, silicone oil was injected into the vitreous cavity, with subsequent surgery scheduled for oil removal. Indications for silicone oil tamponade [14] included the presence of intraoperative complications (e.g., severe bleeding, iatrogenic retinal rupture), inability to completely remove fibrovascular tissue, or extremely long and complex surgical procedures. Representative pre- and post-operative fundus photographs of the observation group are shown in **Figure 1**.

Outcome measures

Visual acuity: Postoperative visual recovery was evaluated at postoperative 6 months. Outcomes were categorized as improved (≥2-line gain or preoperative hand motion improved to counting fingers or better post-treatment), stable (change within ±1 line), or declined (≥2-line loss) [15].

Best-corrected visual acuity (BCVA): BCVA was measured preoperatively and at 3 and 6 months postoperatively using an international standard vision chart.

Central retinal thickness (CRT): Mean CRT across nine macular subfields was assessed using spectral-domain OCT preoperatively and at 3 and 6 months postoperatively.

Intraocular pressure (IOP): IOP was measured preoperatively and at 3 and 6 months postoperatively using a non-contact tonometer.

Surgical parameters: Intraoperative electrocautery frequency, number of eyes with intraoperative hemorrhage, number of silicone oil tamponades, and incidents of iatrogenic retinal injury were recorded. Intraoperative hemorrhage was classified as mild or severe [14]: bleeding that could be controlled by increasing perfusion pressure, blunt instrument compression, or both, was defined as mild bleeding; bleeding requiring endoscopic electrocoagulation was defined as severe.

Preoperative aqueous humor inflammatory cytokines: Preoperative aqueous humor samples were analyzed to determine levels of interferon-gamma (IFN-γ), interleukin-6 (IL-6), and tumor necrosis factor-alpha (TNF-α) using enzyme-linked immunosorbent assay (ELISA).

Postoperative complications: The number of patients developing neovascular glaucoma, macular edema, vitreous re-bleeding, and transient IOP elevation was counted, with the total incidence calculated.

Life quality: The Chinese-version Low Vision Quality-of-Life Questionnaire (CLVQOL) [16] was administered to assess life quality, covering distance vision, mobility and light perception, accommodative ability, daily living activities, and reading/fine motor functions. Each domain was scored out of 100, with scores positively correlated with quality-of-life levels.

Follow-up

All patients completed the 6-month follow-up, conducted every three months via outpatient reviews and medical record inquiry. BCVA, CRT, and IOP were collected at 3 and 6 months postoperatively, along with visual improvement and CLVQOL scores at 6-month.

Statistical analyses

All statistical analyses were performed using SPSS 22.0. Measurement data were first

Table 1. Comparison of baseline characteristics between the two groups

Indicators	Control group (n=52)	Observation group (n=66)	χ^2/t	P
Sex			0.014	0.905
Male	25 (48.08)	31 (46.97)		
Female	27 (51.92)	35 (53.03)		
Age (years)	52.42±8.18	54.65±9.07	1.384	0.169
Diabetic duration (years)	11.15±5.13	11.64±5.00	0.523	0.602
PDR stage			0.579	0.749
IV	20 (38.46)	25 (37.88)		
V	20 (38.46)	22 (33.33)		
VI	12 (23.08)	19 (28.79)		
Affected eye			0.618	0.432
Left	29 (55.77)	32 (48.48)		
Right	23 (44.23)	34 (51.52)		
Hypertension			1.238	0.266
No	29 (55.77)	30 (45.45)		
Yes	23 (44.23)	36 (54.55)		
Preoperative macular edema severity			0.719	0.698
No macular edema	10 (19.23)	17 (25.76)		
Non-center-involved edema	22 (42.31)	25 (37.88)		
Center-involved edema	20 (38.46)	24 (36.36)		
Vitreous hemorrhage duration (months)	38.52±20.61	33.62±17.20	1.407	0.162
Glycated hemoglobin	8.47±2.24	8.44±2.27	0.072	0.943

Note: PDR, proliferative diabetic retinopathy.

assessed for homogeneity of variance using Bartlett's test and for normality using the Kolmogorov-Smirnov test. All data in this study met the assumption of homogeneity of variance and followed a normal distribution, thus expressed as mean ± standard deviation (SD). Repeated measurement variables (e.g., BCVA, CRT, IOP) were analyzed using repeated measures ANOVA to evaluate time effects, group effects, and their interaction. For non-repeated measurement data, independent-sample t-tests were used for between-group comparisons, and paired t-tests for pre- and post-treatment differences within the same group. Categorical data were presented as n (%), and compared using the χ^2 test or Fisher's exact test, as appropriate. A *P* value <0.05 was considered statistically significant.

Results

Baseline characteristics

No significant differences were observed in sex, age, diabetic duration, PDR stage, affected eye, hypertension comorbidity, preoperative macular edema severity, vitreous hemorrhage duration, or glycated hemoglobin (HbA1c) between the two groups (all P>0.05; **Table 1**).

Visual acuity

At 6 months postoperatively, 27 patients in the observation group had improved vision, 25 remained stable, and none experienced vision decline, compared with 48, 18, and 0 cases, respectively, in the control group. The proportion of patients demonstrating visual improvement was significantly higher in the treatment group compared with the control group (72.73% vs. 51.92%, P=0.020; **Table 2**).

BCVA dynamics

Baseline BCVA was (1.80±0.44) in the control group, which was reduced to (1.10±0.46) at postoperative 3 months and further declined to (0.71±0.28) at postoperative 6 months. In the observation group, these values were (1.84±0.50), (0.87±0.34), and (0.42±0.20), respectively. The two groups had similar baseline BCVA levels (P>0.05). Postoperatively,

Table 2. Comparison of visual acuity between the two groups

Indicators	Control group (n=52)	Observation group (n=66)	χ^2	P
Improved	27 (51.92)	48 (72.73)	5.435	0.020
Stable	25 (48.08)	18 (27.27)		
Declined	0 (0.00)	0 (0.00)		

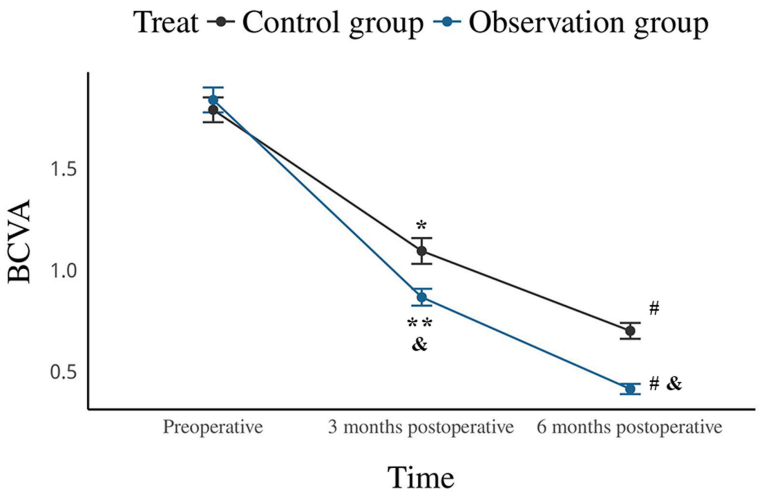

Figure 2. Changes in BCVA in both groups. Note: BCVA, best-corrected visual acuity; *P<0.05, **P<0.01 vs. preoperative (within-group); #P<0.05 vs. 3-month (within-group); &P<0.05 vs. control group (same time point).

BCVA showed a stepwise decrease at postoperative 3 and 6 months in both groups (P<0.05), with significantly lower levels in the research group (P<0.05).

RM-ANOVA revealed a non-significant group main effect (P=0.270), a significant time effect (P<0.001), and a significant time × group interaction (P=0.016), indicating that BCVA improved over time in both groups, with a more pronounced improvement in the treatment group (**Figure 2**).

CRT measurements

Initial CRT measurements revealed no significant difference between groups (P>0.05). Postoperatively, CRT decreased progressively at 3 and 6 months (P<0.05), with a more significant reduction in the observation group compared to the control group (P<0.05). RM-ANOVA showed significant main effects for group (P=0.009) and time (P<0.001), as well as a significant group × time interaction (P=0.006), indicating significant differences in CRT both across groups and over time (**Table 3**).

IOP changes across groups

Baseline IOP did not differ statistically between groups (P>0.05). Postoperatively, IOP decreased significantly at 3 and 6 months postoperatively in both groups (P<0.05), with the observation group demonstrating significantly lower IOP values compared to the control group (both P<0.05). RM-ANOVA revealed significant main effects for group (P=0.001) and time (P<0.001), as well as a significant time × group interaction (P=0.005), indicating significant differences in IOP over time and between groups (**Table 4**).

Surgical parameters

The observation group showed significantly reduced intraoperative electrocoagulation frequency, fewer eyes with intraoperative hemorrhage, fewer silicone oil tamponades, and lower incidence of iatrogenic retinal injury compared to the control group (P<0.05; **Table 5**).

Preoperative inflammatory cytokine concentrations in the aqueous humor

Preoperative aqueous humor inflammatory markers, including IFN-γ, IL-6, and TNF-α, were measured in both groups. The levels of IFN-γ, IL-6, and TNF-α in the control group were (18.88±5.00) pg/mL, (21.94±3.88) pg/mL, and (19.06±4.23) pg/mL, respectively, while those in the observation group were (12.53±4.20) pg/mL, (15.03±3.58) pg/mL, and (14.48±4.04) pg/mL, respectively. All three inflammatory cytokines were significantly reduced in the observation group compared with the control group (all P<0.001; **Figure 3**).

Postoperative complications

The recorded postoperative adverse events included neovascular glaucoma, macular edema, vitreous re-bleeding, and transient IOP elevation. The total incidence of complications

Table 3. Comparison of CRT between the two groups

CRT (μm)	Control group (n=52)	Observation group (n=66)	t	P
Pre-operation	362.52±59.39	372.67±65.46	0.871	0.386
3 months post-operation	310.40±63.66*	285.00±35.39*	2.749	0.007
6 months post-operation	265.62±47.01**	234.29±39.60**	3.928	<0.001
$t_{3 \text{ vs. } 6 \text{ months post-operation}}$	4.080	7.757		
$P_{3 \text{ vs. } 6 \text{ months post-operation}}$	<0.001	<0.001		

Note: CRT, central retinal thickness; *P<0.05, **P<0.01 vs. preoperative (within-group).

Table 4. Comparison of postoperative IOP between the two groups

IOP (mmHg)	Control group (n=52)	Observation group (n=66)	t	P
Pre-operation	17.40±2.97	17.38±3.28	0.034	0.973
3 months post-operation	15.52±2.82*	13.18±2.37*	4.896	<0.001
6 months post-operation	13.38±2.82**	12.29±2.70**	2.524	0.013
$t_{3 \text{ vs. } 6 \text{ months post-operation}}$	3.869	2.013		
$P_{3 \text{ vs. } 6 \text{ months post-operation}}$	<0.001	0.046		

Note: IOP, intraocular pressure; *P<0.05, **P<0.01 vs. preoperative (within-group).

Table 5. Comparison of surgical parameters between the two groups

Indicators	Control group (n=52)	Observation group (n=66)	t/Fisher's	P
Frequency of intraoperative electrocoagulation	10 (19.23)	3 (4.55)	-	0.016
Number of eyes with intraoperative hemorrhage	15 (28.85)	7 (10.61)	6.380	0.012
Number of silicone oil tamponades	13 (25.00)	7 (10.61)	4.281	0.039
Incidents of iatrogenic retinal injury	11 (21.15)	2 (3.03)	-	0.002

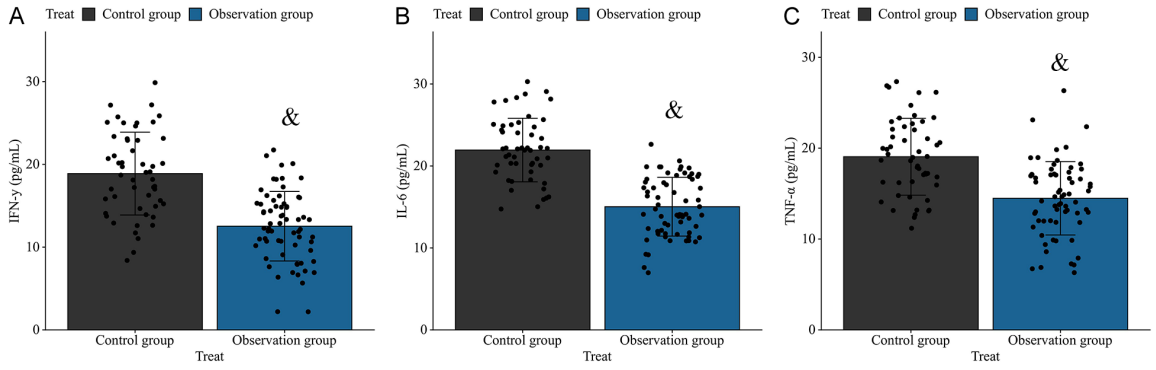

Figure 3. Comparison of inflammatory cytokine levels in preoperative aqueous humor samples. A. Preoperative IFN-γ concentrations. B. Preoperative IL-6 concentrations. C. Preoperative TNF-α concentrations. Note: IFN-γ, interferon-gamma; IL-6, interleukin-6; TNF-α, tumor necrosis factor-alpha; &P<0.05 vs. controls.

was significantly lower in the observation group than the control group (16.67% vs. 32.69%, P=0.001; **Table 6**).

All the cases of neovascular glaucoma in this study were mild to moderate. IOP was controlled to within the normal range (<21 mmHg) within 2-4 weeks using topical application of Brinzolamide and Timolol Maleate Eye Drops (twice a day), Latanoprost Eye Drops (once nightly), and panretinal photocoagulation. All macular edema cases presented with localized retinal thickening without foveal involvement; triamcinolone acetonide was injected into the

Table 6. Comparison of postoperative complications between the two groups

Indicators	Control group (n=52)	Observation group (n=66)	χ^2	P
Neovascular glaucoma	3 (5.77)	3 (4.55)		
Macular edema	4 (7.69)	2 (3.03)		
Vitreous re-bleeding	4 (7.69)	2 (3.03)		
Transient IOP elevation	6 (11.54)	4 (6.06)		
Total occurrence	17 (32.69)	11 (16.67)	4.127	0.042

Note: IOP, intraocular pressure.

vitreous cavity (4 mg/0.1 mL), and OCT re-examination 3 months after the injection showed complete resolution of the edema. Mild vitreous re-bleeding cases were managed conservatively with semi-recumbent rest and oral Yunnan Baiyao capsules to promote blood absorption; the bleeding was absorbed spontaneously within 2-4 weeks without secondary operation. Transient IOP elevation cases experienced short-term increase in IOP, which returned to normal within 72 hours; only close monitoring was carried out, with no use of hypotensive drugs.

Quality-of-life outcomes

Quality of life was assessed using the CLVQOL questionnaire preoperatively and at 6 months post-surgery. No significant differences were observed in baseline scores across all domains between the two groups (all P>0.05). At 6 months, significant improvements were observed in all domains in both groups (P<0.05). Additionally, the observation group demonstrated markedly higher scores than the control group across all CLVQOL dimensions (P< 0.001). RM-ANOVA showed significant differences between groups, over time, and in group × time interaction for all quality-of-life domains (P<0.05; **Table 7**).

Discussion

In this study, the pre-PPV Conbercept administration in PDR patients substantially enhanced postoperative visual recovery, reflected by lower BCVA values at 3 and 6 months postoperatively compared with PPV alone. This may be related to Conbercept's high affinity for all VEGF isoforms and its prolonged half-life, which sustain VEGF inhibition and maximize therapeutic efficacy [17]. Chen et al. [18] also reported better BCVA outcomes, shorter vitreous clearance time, and reduced surgical duration with the treatment of Conbercept with PPV, complementing our findings.

In addition, adjunctive Conbercept in PPV facilitated greater reductions in postoperative CRT and IOP at 3 and 6 months versus PPV alone. This may be related to the rapid down-regulation of VEGF levels in the retina, inhibiting neovascularization and vascular leakage, thus alleviating macular edema and reducing CRT. Its influence on IOP may stem from VEGF antagonism, which effectively suppresses neovascularization in the iris and chamber angle, contributing to IOP reduction. Consistently, Cheng et al. [19] observed that Conbercept plus retinal photocoagulation improved BCVA and reduced CRT within 1-48 months postoperatively.

Compared with ranibizumab, Conbercept has a broader VEGF target spectrum and higher binding affinity, and can penetrate ganglion cells, inner/outer retinal layers, and pigment epithelium. This enables more effective VEGF inhibition at the molecular level, reduces macular edema, and promotes retinal structural recovery, thus contributing to superior visual outcomes in PDR patients [20]. Conbercept combined with PPV also resulted in fewer intraoperative coagulations, reduced number of eyes with bleeding, lower silicone oil tamponade requirements, and fewer iatrogenic retinal injuries. Preoperative intravitreal Conbercept likely prevents the surgical field from being obscured by fresh hemorrhage, minimizing retinal vessel trauma during membrane dissection, and improving surgical outcomes. In the study of Wang et al. [21], Conbercept plus PPV effectively prevented severe intraoperative bleeding and reduced the need for bipolar coagulation, risk of iatrogenic retinal injury, and postoperative silicone oil use, similar to our results. Fan et al. [22] also reported that preoperative intravitreal anti-VEGF injection can be used as an adjuvant to PPV in PDR patients, reducing the risk of intraoperative vitreous hemorrhage and retinal tears, further supporting our findings.

Table 7. Comparison of quality of life between the two groups

Indicators	Control group (n=52)	Observation group (n=66)	t	P
Distance vision, mobility, and light perception (points)				
Pre-operation	40.69±5.74	40.70±6.33	0.009	0.993
6 months post-operation	70.10±6.64*	77.85±9.18**	5.121	<0.001
Group main effect *P*-value	<0.001			
Time main effect *P*-value	<0.001			
Group × Time interaction *P*-value	<0.001			
Accommodative ability (points)				
Pre-operation	42.40±4.85	42.55±5.78	0.150	0.881
6 months post-operation	72.87±6.78*	80.64±8.17**	5.521	<0.001
Group main effect *P*-value	<0.001			
Time main effect *P*-value	<0.001			
Group × Time interaction *P*-value	<0.001			
Daily living activities (points)				
Pre-operation	40.00±6.73	40.67±6.65	0.540	0.590
6 months post-operation	77.77±6.77*	84.64±7.27**	5.252	<0.001
Group main effect *P*-value	<0.001			
Time main effect *P*-value	<0.001			
Group × Time interaction *P*-value	<0.001			
Reading and fine motor functions (points)				
Pre-operation	42.75±6.25	43.17±7.85	0.315	0.753
6 months post-operation	71.67±6.81*	76.85±8.65**	3.539	<0.001
Group main effect *P*-value	0.006			
Time main effect *P*-value	<0.001			
Group × Time interaction *P*-value	0.018			

Note: *P<0.05, **P<0.01 vs. preoperative (within-group).

IFN-γ, IL-6, and TNF-α are classical inflammatory markers that play critical roles in pathogenesis and serve as potential therapeutic targets of DR [23]. IFN-γ can disrupt the blood-retina barrier and trigger recruitment of inflammatory cells and other cytokines, thus promoting neovascularization and neuroglial degeneration; down-regulation of IFN-γ ameliorates the inflammatory microenvironment and inhibits abnormal angiogenesis [24, 25]. IL-6 promotes VEGF expression, enhancing vascular permeability and angiogenesis, and can serve as a substitute marker to predict the proliferation stage of DR; its reduction contributes to alleviating DR severity and mitigating diabetic macular edema [26, 27]. Both TNF-α and IL-6 are systemic inflammation markers that help predict DR severity and differentiate NPDR from PDR [28]. Our ELISA results showed that Conbercept combined with PPV notably inhibited aqueous humor inflammatory factors (IFN-γ, IL-6, TNF-α) compared with PPV alone. Huang et al. [29] similarly reported the Conbercept plus PPV markedly inhibited inflammatory mediators such as TNF-α in PDR patients. This may be related to Conbercept's modulation of the protein profile in aqueous humor via the connective tissue growth factor (CTGF)/VEGF axis, thus restoring the inflammatory microenvironment homeostasis [30]. As an anti-VEGF agent, the potential mechanisms by which Conbercept regulates the inflammatory microenvironment through the CTGF/VEGF axis may involve: (1) direct inhibition of the VEGF signaling pathway, suppressing the expression of downstream inflammatory factors such as IL-6 and TNF-α; (2) indirect reduction of inflammatory cell infiltration and local inflammatory responses by lowering vascular permeability and pathological neovascularization. These proposed molecular mechanisms remain to be validated through future mechanistic studies.

Regarding safety, the combined intervention resulted in a lower overall incidence of complications, including neovascular glaucoma, macular edema, vitreous re-bleeding, and transient IOP elevation (16.67% vs. 32.69%), compared with PPV alone. This may be attributed to Conbercept-induced regression of neovascularization, enhanced hemostasis of potential bleeding sources, and stabilization of retinal vasculature. Therefore, its pre-treatment is beneficial for reducing early postoperative bleeding [31]. Ding et al. [32] similarly reported that Conbercept+PPV not only improved postoperative vision in PDR patients, but also decreased surgery-related complications, aligning with our results.

Finally, quality-of-life assessment using CLVQ-OL indicated that Conbercept combined with PPV more effectively enhanced life quality at 6 months postoperatively. This might be related to the superior visual recovery and reduced risk of postoperative complications, which enables patients to achieve optimal surgical outcomes and recover more quickly, thereby effectively improving their life quality. Wang et al. conducted a meta-analysis comparing intravitreal Conbercept injection with triamcinolone acetonide in DR patients, yielding similar conclusions that Conbercept more effectively enhanced daily activities, mobility, social functioning, and mental health [33].

Beyond PDR, Conbercept has demonstrated efficacy in other ocular conditions. Zhou et al. [34] pointed out that Conbercept was more cost-effective than ranibizumab for neovascular age-related macular degeneration. Yang et al. [35] also reported that intravitreal Conbercept administered 7 days prior to PPV in PDR patients significantly reduced intraoperative bleeding rates and was more effective in improving or maintaining visual acuity.

This study has several limitations. First, the occurrence time of complications in PDR patients was not recorded, making it difficult to distinguish between early and long-term risks and thus limiting the dynamic evaluation of treatment safety. Future studies should establish a dynamic complication monitoring system that includes onset time, duration, and progression as core indicators to more accurately evaluate treatment safety. Second, key confounders that may influence outcomes, such as diabetes glycemic control, hypertension duration, preoperative macular edema severity, and vitreous hemorrhage duration, were not evaluated. Future analyses should incorporate these variables prospectively into statistical models to reduce potential bias. Third, no basic mechanistic experiments were conducted to explore the underlying mechanisms of Conbercept combined with PPV in treating PDR; animal experiments are warranted to further clarify the potential mechanism. Finally, the study did not conduct long-term follow-up (3-5 years), lacking data on long-term efficacy and prognostic benefits. Future investigations are needed to explore the potential long-term clinical advantages of Conbercept combined with PPV.

Conclusion

Conbercept combined with PPV demonstrates superior clinical outcomes in treating PDR compared with PPV alone at 6 months postoperatively. This combination therapy improves visual acuity, suppresses preoperative aqueous humor inflammatory markers, enhances quality of life, and exhibits a favorable safety profile.

Disclosure of conflict of interest

None.

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