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ORIGINAL ARTICLE

IMPROVEMENT OF HEALTH-RELATED QUALITY OF LIFE FOLLOWING MICROPULSE TRANSSCLERAL CYCLOPHOTOCOAGULATION IN NEOVASCULAR GLAUCOMA: A RETROSPECTIVE ANALYSIS

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Abstract

Neovascular glaucoma (NVG) is one of the most severe and prognostically unfavorable variants of secondary glaucoma, characterized by persistent elevation of intraocular pressure (IOP), progressive deterioration of visual function, and a pronounced negative impact on patients' quality of life. The condition arises from pathological neovascularization of the iris and the anterior chamber angle, leading to fibrovascular membrane formation and obstruction of aqueous humor outflow, rendering IOP resistant to conventional therapy. NVG is most commonly associated with proliferative diabetic retinopathy and ischemic central retinal vein occlusion, which provoke retinal ischemia, activation of vascular endothelial growth factor (VEGF), and aberrant anterior-segment angiogenesis. Given that NVG impairs not only visual function but also emotional well-being, social activity, and independence, treatment evaluation must incorporate quality-of-life assessment. The present study examines changes in quality of life before and after micropulse transscleral cyclophotocoagulation (MTSCPC) using the validated NEI VFQ-25 questionnaire, demonstrating that MTSCPC yields statistically significant improvements across all measured domains.

Keywords: neovascular glaucoma, secondary glaucoma, micropulse transscleral cyclophotocoagulation, intraocular pressure, quality of life, visual function, psychoemotional status, social functioning, NEI VFQ-25, laser treatment, retinal ischemia, neovascularization.

1. Introduction

Neovascular glaucoma (NVG) represents one of the most formidable challenges in contemporary ophthalmology, distinguished by an aggressive clinical course, pronounced resistance to pharmacological therapy, and a high probability of irreversible visual loss. As a secondary form of glaucoma, NVG emerges as a complication of ischemic retinal and ocular diseases that precipitate pathological changes within the anterior segment. Persistent IOP elevation, progressive optic

neuropathy, and rapid functional deterioration are the cardinal hallmarks of this condition [1, 2]. From a pathogenetic standpoint, NVG is principally driven by retinal ischemia, which stimulates upregulation of VEGF and other proangiogenic mediators, inducing abnormal neovascularization of the iris (rubeosis iridis) and the iridocorneal angle. The resulting fibrovascular membrane occludes the trabecular meshwork, establishing a mechanically obstructed outflow pathway and pharmacologically intractable ocular hypertension [3, 5].

Epidemiologically, secondary glaucoma constitutes approximately 6–22% of all glaucoma cases globally, with NVG accounting for around 7% of glaucoma diagnoses. Despite its comparatively lower prevalence, NVG inflicts a disproportionate burden owing to severe pain, rapid progression, and devastating quality-of-life consequences [8]. Proliferative diabetic retinopathy is implicated in over two-thirds of NVG cases; ischemic central retinal vein occlusion constitutes the second most frequent aetiology [6, 7].

Clinically, NVG presents with severe ocular pain, photophobia, ciliary injection, and accelerating visual deterioration. Without effective intervention, total blindness is a likely outcome [4]. The chronic, painful, and visually devastating nature of NVG exerts a profound toll on patients' psychological equilibrium, social integration, and overall quality of life.

Micropulse transscleral cyclophotocoagulation (MTSCPC) has emerged as a clinically promising minimally invasive modality. In contrast to continuous-wave cyclodestructive procedures, MTSCPC delivers laser energy in brief, intermittent pulses with defined rest intervals, enabling selective ciliary body treatment with minimal collateral tissue destruction [8, 10, 11]. Given the chronic and debilitating nature of NVG, treatment assessment must extend beyond IOP metrics to encompass patient-reported quality-of-life outcomes. The present investigation therefore aims to evaluate the effect of MTSCPC on health-related quality of life in patients with neovascular glaucoma.

2. Materials and Methods

The study was conducted as a retrospective analysis and enrolled 30 patients treated for NVG at the Department of Ophthalmology of the First Multidisciplinary Clinical Hospital of Samarkand State Medical University and at the Professor A.A. Yusupov Eye Centre. Data were extracted from archival medical records and covered demographic characteristics, clinical indices, and examination findings recorded before and after treatment.

Inclusion criteria comprised: (1) a clinically and instrumentally verified diagnosis of neovascular glaucoma; (2) persistently elevated IOP refractory to maximal tolerated medical therapy; and (3) absence of contraindications to laser intervention. Patients presenting with concomitant ocular pathologies capable of independently influencing visual function were excluded.

All participants underwent a standardised, comprehensive ophthalmological evaluation encompassing: best-corrected and uncorrected visual acuity measurement; pneumatic applanation tonometry; automated static perimetry; slit-lamp biomicroscopy of the anterior segment; indirect ophthalmoscopy of the retina and optic nerve head; gonioscopy for anterior chamber angle assessment; high-frequency ultrasound biomicroscopy; and B-scan ocular ultrasonography. MTSCPC was performed in accordance with established clinical protocols, targeting selective reduction of aqueous humor production through controlled ciliary body treatment.

Health-related quality of life was evaluated using the National Eye Institute Visual Function Questionnaire-25 (NEI VFQ-25) at baseline and following completion of the postoperative follow-up period. The NEI VFQ-25 encompasses multiple subscales assessing visual function, daily activity limitations, ocular pain, psychoemotional status, social functioning, and global visual satisfaction, with scores ranging from 0 to 100 (higher scores indicating better quality of life).

Statistical analysis involved calculation of means and standard deviations for all continuous variables. Pre- and post-treatment comparisons were performed using appropriate parametric tests; a p-value below 0.05 was considered statistically significant.

3. Results

Pre-interventional NEI VFQ-25 assessment revealed a markedly compromised baseline quality-of-life profile, with a mean overall score of 45.2 ± 8.7 points. This depressed composite value reflects severe limitation of vision-dependent daily activities, pronounced psychoemotional distress, high pain burden, substantial reduction in working capacity, and a pervasive sense of loss of autonomy. These

findings align with published evidence demonstrating substantially lower quality-of-life indices in patients with refractory glaucomatous conditions compared to those with milder disease [8, 11].
Following MTSCPC, a statistically significant improvement in the composite NEI VFQ-25 score was observed, rising to 68.4 ± 9.3 points ($p < 0.001$). This improvement reflects comprehensive gains across both objective clinical parameters—including IOP reduction and decreased hypotensive pharmacological burden—and subjective patient-reported outcomes, encompassing attenuation of pain, diminished anxiety, and relaxation of social participation constraints.
Domain-level analysis demonstrated consistent positive trajectories across all subscales (Table 1). Visual function scores increased from 40.5 ± 7.8 to 72.3 ± 8.2 points, indicating meaningful improvement in optical resolution, reduction of visual discomfort, and enhanced capacity for vision-dependent task performance. Psychoemotional subscale scores rose from 42.1 ± 6.5 to 69.0 ± 7.6 points, reflecting reduced anxiety, irritability, and emotional tension alongside increased confidence in disease self-management.
Daily activity performance scores improved from 39.3 ± 7.3 to 66.7 ± 8.0 points, denoting enhanced independence, improved spatial orientation, and facilitated execution of household, professional, and social tasks. Social functioning scores progressed from 46.7 ± 8.1 to 68.2 ± 9.1 points, demonstrating broader social engagement and reduced interpersonal isolation. Overall visual satisfaction scores increased from 50.0 ± 9.0 to 75.0 ± 8.0 points, indicating a more favourable subjective appraisal of treatment outcomes (Table 1).

Table 1. NEI VFQ-25 domain scores before and after MTSCPC (mean ± SD; n = 30)

NEI VFQ-25 Domain	Pre-MTSCPC (mean ± SD)	Post-MTSCPC (mean ± SD)	p-value
Composite score	45.2 ± 8.7	68.4 ± 9.3	≤ 0.001
Visual function	40.5 ± 7.8	72.3 ± 8.2	≤ 0.001
Psychoemotional status	42.1 ± 6.5	69.0 ± 7.6	≤ 0.001
Daily activities	39.3 ± 7.3	66.7 ± 8.0	≤ 0.001
Social functioning	46.7 ± 8.1	68.2 ± 9.1	≤ 0.001
Overall visual satisfaction	50.0 ± 9.0	75.0 ± 8.0	≤ 0.001

Note: All between-timepoint comparisons were statistically significant at $p < 0.001$ (paired-samples t-test). SD = standard deviation; MTSCPC = micropulse transscleral cyclophotocoagulation.

Figure 1. Figure 1

4. Discussion

The present findings corroborate accumulating evidence that MTSCPC constitutes a valuable component of multimodal therapy for neovascular glaucoma. The durable intraocular hypotensive effect, combined with meaningful gains across all NEI VFQ-25 domains, underscores the multidimensional therapeutic benefit of this approach beyond mere tonometric control [5, 8].
The observed improvement in psychoemotional well-being is particularly noteworthy. Emotional distress and social isolation are well-recognised determinants of quality of life in chronic ophthalmic conditions; their mitigation following MTSCPC reflects the procedure's capacity to address not only the physiological but also the psychosocial sequelae of NVG [9, 11]. The alleviation of chronic ocular pain appears to be a pivotal mediating factor in this regard.
The favourable safety profile of micropulse technology—characterised by selective, tissue-sparing energy delivery and a low incidence of serious adverse events—differentiates it from conventional continuous-wave cyclodestructive procedures and renders it suitable for repeat application when clinically indicated [3, 10]. Published studies with follow-up durations extending to 24 months or beyond consistently demonstrate stability of the clinical effect [8].
Several limitations of the present study warrant acknowledgement. The retrospective design and relatively modest sample size (n = 30) constrain the generalisability of findings. The absence of a control group precludes direct causal attribution of observed improvements to MTSCPC alone. Future prospective, randomised, controlled trials incorporating larger and demographically diverse cohorts,

stratified age-group analyses, extended longitudinal follow-up, and systematic documentation of concomitant therapies are necessary to consolidate evidence on long-term efficacy, optimal laser parameter configuration, and comparative effectiveness relative to alternative surgical modalities.

5. Conclusion

Micropulse transscleral cyclophotocoagulation represents a clinically effective and patient-centred treatment modality for neovascular glaucoma. Its application yields statistically significant improvements in health-related quality of life, encompassing visual function, psychoemotional equilibrium, daily activity performance, social functioning, and global visual satisfaction, alongside objective tonometric benefits. These findings support the broader integration of MTSCPC into the clinical management of advanced NVG, particularly in patients with refractory responses to conventional therapies or elevated surgical risk profiles. Incorporating patient-reported quality-of-life measures alongside objective clinical endpoints is strongly recommended as a standard component of treatment effectiveness evaluation in glaucoma care.

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