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ROLE OF ARGON LASER IN CHRONIC CENTRAL SEROUS CHORIORETINOPATHY (CSCR) IN TERMS OF MEAN CHANGE IN BEST CORRECTED VISUAL ACUITY

Original Research

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ABSTRACT

Background: Central serous chorioretinopathy (CSCR) is a common retinal disorder characterized by serous detachment of the neurosensory retina due to dysfunction of the retinal pigment epithelium and choroid. Chronic CSCR, defined by persistent subretinal fluid for more than four months, may result in permanent visual impairment if left untreated. Argon laser photocoagulation has been employed to promote subretinal fluid absorption by sealing the leakage point and enhancing RPE function. However, risks such as choroidal neovascularization and retinal scarring warrant careful evaluation of its efficacy.

Objective: To determine the mean change in best corrected visual acuity (BCVA) following argon laser application in adults diagnosed with chronic CSCR.

Methods: This descriptive case series was conducted at Eye Unit I, Department of Ophthalmology, Allied Hospital Faisalabad, affiliated with Faisalabad Medical University, from March 1 to August 31, 2021. A total of 35 patients, aged 16–70 years, with chronic CSCR confirmed on OCT and FFA, were selected via non-probability consecutive sampling. Exclusion criteria included repeat laser therapy, choroidal neovascularization, inflammatory/neoplastic choroidal disease, or congenital optic disc anomalies. Baseline BCVA was assessed using Snellen's chart. Argon green laser (514 nm) was applied to leakage points at least 500 µm away from the fovea by a senior consultant. Patients were followed up at 4, 8, and 12 weeks for BCVA reassessment.

Results: Mean BCVA improved from 0.35 ± 0.04 at baseline to 0.68 ± 0.05 at 4 weeks, 0.89 ± 0.02 at 8 weeks, and 0.98 ± 0.03 at 12 weeks. The overall mean change in BCVA was 0.64 ± 0.05.

Conclusion: Argon laser photocoagulation significantly improved visual acuity in chronic CSCR patients and may be considered a safe, effective treatment where focal leakage is present.

Keywords: argon laser photocoagulation, best corrected visual acuity, chronic disease, laser therapy, optical coherence tomography, retinal pigment epithelium, serous retinal detachment.

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INTRODUCTION

Central serous chorioretinopathy (CSCR) is a retinal disorder characterized by serous detachment of the neurosensory retina resulting from dysfunction at the level of the choroid and retinal pigment epithelium (1). It predominantly affects young to middle-aged men between the ages of 20 and 50 years, although cases have also been reported in older individuals and females (2). CSCR is recognized as the fourth most common non-surgical retinopathy and typically follows a self-limiting course. However, in a subset of patients, the condition presents with a chronic or recurrent pattern, leading to distressing and sometimes permanent visual impairment. The introduction of advanced multimodal imaging techniques has significantly improved the understanding of CSCR pathophysiology and enabled more precise diagnosis and management strategies (3). Although acute CSCR often resolves spontaneously within six months without the need for intervention, chronic cases are more challenging, often associated with persistent subretinal fluid, photoreceptor damage, and lasting visual disturbances. To address this, a variety of treatment options have been developed. Current therapeutic strategies for chronic CSCR include photodynamic therapy, oral administration of aldosterone antagonists, subthreshold laser therapies, and ongoing investigations into the potential role of anti-vascular endothelial growth factor agents (4,5). Among these, direct laser photocoagulation using an argon laser has demonstrated promising outcomes when applied to focal retinal pigment epithelial leakage sites, especially in cases where fluid persistence extends beyond four months (6).

Clinical studies have reported that focal laser treatment may expedite the resolution of subretinal fluid, enhance best-corrected visual acuity (BCVA), and reduce the risk of recurrence, provided that the leakage site is well-defined and located away from the subfoveal area (7,8). Despite these advantages, laser photocoagulation carries potential risks such as the development of scotomas or choroidal neovascularization. Moreover, some evidence suggests that while the intervention may hasten visual recovery, it may not significantly alter long-term visual outcomes or prevent recurrence (9,10). Nevertheless, improvements in BCVA have been documented, with one study showing a progressive increase from 0.32±0.16 at baseline to 0.98±0.14 at 12 weeks post-treatment (11). Despite these findings, there remains a paucity of local data evaluating the efficacy of argon laser treatment for chronic CSCR, particularly in South Asian populations where healthcare access and disease patterns may differ. Most of the existing evidence is derived from studies conducted in other regions, limiting the generalizability of results. Hence, there is a clear need for region-specific research that could validate the effectiveness of this treatment modality within the local context and potentially shape clinical decision-making. The objective of this study is to determine the mean change in best-corrected visual acuity with argon laser treatment in adults diagnosed with chronic central serous chorioretinopathy. By generating local evidence, the study aims to contribute to evidence-based practices and support improved visual outcomes and patient satisfaction in the management of this condition.

METHODS

This descriptive case series was conducted at Eye Unit I, Department of Ophthalmology, Allied Hospital Faisalabad, affiliated with Faisalabad Medical University (FMU), over a six-month period from March 1st, 2021, to August 31st, 2021. The study aimed to evaluate the change in best-corrected visual acuity (BCVA) following argon laser treatment in adult patients diagnosed with chronic central serous chorioretinopathy (CSCR). Ethical approval for the study was obtained from the Institutional Review Board of FMU, and written informed consent was secured from all participants prior to inclusion. A total of 35 patients were enrolled, based on a sample size calculation using the World Health Organization (WHO) sample size calculator. The calculation was performed using a 95% confidence level, a margin of error of 0.01, and a previously reported mean change in BCVA of 0.59 ± 0.03 after argon laser treatment for CSCR. The sampling technique used was non-probability consecutive sampling. Participants were eligible if they were aged between 16 and 70 years, of either gender, and had a confirmed diagnosis of CSCR based on optical coherence tomography (OCT) and fundus fluorescein angiography (FFA) findings, which demonstrated serous retinal detachment with pigment epithelial detachment or a definite leakage point. Only patients with persistent CSCR lasting longer than six months and with evidence of chronicity were considered for laser treatment. Exclusion criteria included prior laser treatment for CSCR, presence of choroidal neovascularization, inflammatory or neoplastic choroidal disorders, or congenital optic nerve pit, as documented in medical records.

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Patients were registered through the outpatient department and demographic information, including name, age, gender, laterality of the affected eye, and duration of symptoms, was documented. Baseline BCVA was measured using the Snellen visual acuity chart under standardized lighting conditions. Each participant then underwent argon green laser treatment (wavelength 514 nm), administered by a senior ophthalmologist (12). The energy settings and duration of the laser were individualized according to the size of the leakage site and retinal response, ensuring laser application resulted in subtle retinal blanching while avoiding permanent damage to the fovea. All laser shots were placed at a minimum distance of 500 µm from the foveal center. Post-treatment follow-up assessments were conducted at 4, 8, and 12 weeks (13). During each visit, BCVA was re-evaluated using the same Snellen chart and testing conditions to ensure consistency. The mean change in BCVA at each time point was recorded according to the operational definition and documented using a structured proforma. Data analysis was performed using SPSS version 22. Descriptive statistics including mean and standard deviation were calculated for continuous variables such as age, duration of symptoms, and BCVA measurements. Frequencies and percentages were reported for categorical variables such as gender and affected eye. Changes in BCVA over time were evaluated using repeated measures analysis of variance (ANOVA), with statistical significance set at a p-value ≤ 0.05. To account for potential confounding variables, data were stratified based on age, gender, laterality, and symptom duration. Post-stratification, repeated measures ANOVA was again applied within each stratum to assess changes in visual acuity over the follow-up period.

RESULTS

The study included 35 patients diagnosed with chronic central serous chorioretinopathy, with ages ranging from 16 to 70 years. The mean age of the patients was 49.26 ± 9.26 years. A majority of patients (71.43%) were within the age group of 46–70 years, while the remaining 28.57% were aged 16–45 years. Gender distribution revealed that 30 out of 35 patients (85.71%) were male and 5 patients (14.29%) were female, yielding a male-to-female ratio of 6:1. The mean duration of CSCR among the participants was 11.77 ± 2.64 months. Stratification based on disease duration showed that 57.14% of patients had CSCR for ≤12 months, whereas 42.86% had a duration of more than 12 months. Regarding laterality, the distribution between right and left eye involvement was nearly equal, with no significant predominance observed. The mean best-corrected visual acuity (BCVA) measured in LogMAR at baseline was 0.35 ± 0.04. At 4 weeks following argon laser photocoagulation, BCVA improved to 0.68 ± 0.05. Further improvement was recorded at 8 weeks (0.89 ± 0.02) and at 12 weeks post-treatment (0.98 ± 0.03). The overall mean change in BCVA over 12 weeks was calculated as 0.64 ± 0.05.

When stratified by age groups, the mean change in BCVA was 0.63 ± 0.06 for patients aged 16–45 years and 0.64 ± 0.04 for those aged 46–70 years, with no statistically significant difference ($p = 0.466$). Similarly, the mean change in BCVA was 0.64 ± 0.05 among males and 0.64 ± 0.06 among females ($p = 0.898$). The duration of CSCR also showed no significant impact on the change in BCVA, with mean changes of 0.64 ± 0.04 for patients with ≤12 months of disease and 0.64 ± 0.05 for those with >12 months ($p = 0.841$). Stratification based on laterality revealed identical improvements in BCVA for both right and left eye involvement (0.64 ± 0.05 vs. 0.64 ± 0.04 respectively; $p = 0.896$). Based on a multivariate analysis of baseline characteristics, including age group, gender, duration of CSCR, and laterality, none of the variables independently influenced the final best-corrected visual acuity (BCVA) outcome following argon laser treatment. The results showed consistent mean improvements in BCVA across all subgroups, with minimal variance and statistically non-significant p-values. Specifically, patients aged 16–45 years and those aged 46–70 years demonstrated comparable mean BCVA improvements of 0.63 ± 0.06 and 0.64 ± 0.04 respectively ($p = 0.466$). Similarly, gender had no measurable impact, with both male and female participants showing identical mean changes of 0.64 ($p = 0.898$). Duration of CSCR ≤12 months versus >12 months also yielded identical outcomes (mean change = 0.64, $p = 0.841$), and no difference was observed based on the affected eye (right vs. left; $p = 0.896$). These findings suggest that within this cohort, argon laser therapy produced uniformly favorable outcomes in terms of visual acuity improvement, independent of patient demographic or clinical baseline variables. However, due to the short follow-up period of only 12 weeks, the study could not assess long-term visual stability or the rate of recurrence, highlighting the need for extended observation in future research.

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Table 1: Distribution of patients according to Age (n=35).

Age (in years)	No. of Patients	%
16-45	10	28.57
46-70	25	71.43
Total	35	100.0

Note: Mean ± SD = 49.26 ± 9.26

Table 2: Distribution of patients according to chronic central serous chorioretinopathy (n=35).

chronic central serous chorioretinopathy (months)	No. of Patients	%age
≤12	20	57.14
>12	15	42.86

Note: Mean ± SD = 11.77 ± 2.64

Table 3: Stratification of Mean Change in BCVA with Respect to Age Groups and Gender

Variable	Category	Mean Change in BCVA	SD	P-value
Age Group	16–45	0.63	0.06	0.466
	46–70	0.64	0.04	
Gender	Male	0.64	0.05	0.898
	Female	0.64	0.06	

Table 4: Stratification of Mean Change in BCVA with Respect to Duration of CSCR and Laterality

Variable	Category	Mean Change in BCVA	SD	P-value
Duration of CSCR	≤12 months	0.64	0.04	0.841
	>12 months	0.64	0.05	
Laterality	Right	0.64	0.05	0.896
	Left	0.64	0.04	

Table 5: Multivariate Analysis of Baseline Characteristics and Final BCVA Outcomes

Variable	Category	Mean Change in BCVA	Standard Deviation	p-value
Age Group	16–45 years	0.63	0.06	0.466
	46–70 years	0.64	0.04	
Gender	Male	0.64	0.05	0.898
	Female	0.64	0.06	
Duration of CSCR	≤12 months	0.64	0.04	0.841
	>12 months	0.64	0.05	
Laterality	Right Eye	0.64	0.05	0.896
	Left Eye	0.64	0.04	

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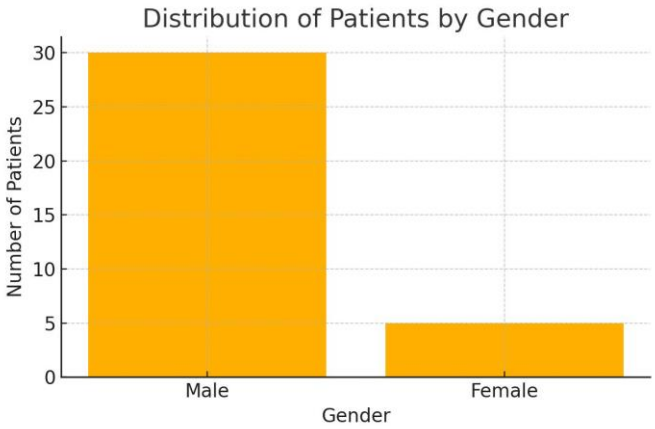


Figure 1 Distribution of Patients by Gender

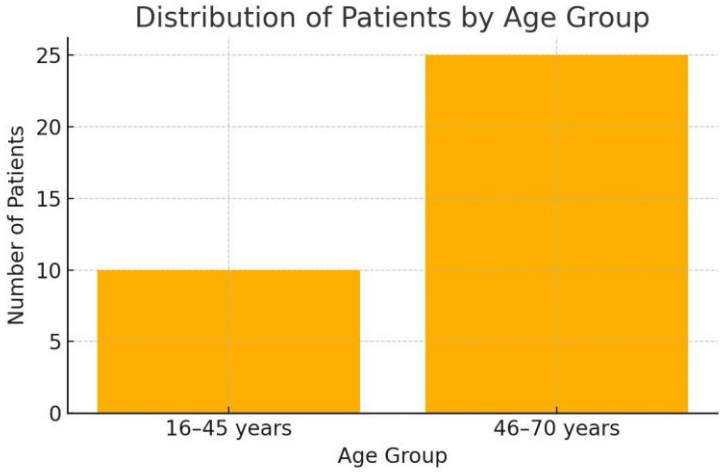
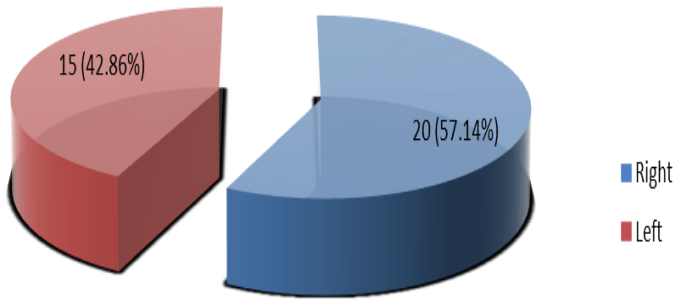


Figure 2 Distribution of Patients by Age Group



Distribution of patients according to laterlaity (n=35)

DISCUSSION

The findings of this study demonstrated a consistent and significant improvement in best-corrected visual acuity (BCVA) following argon laser photocoagulation in patients with chronic central serous chorioretinopathy (CSCR). The mean BCVA improved from 0.35 ± 0.04 at baseline to 0.98 ± 0.03 at 12 weeks post-treatment, with a mean change of 0.64 ± 0.05. This pattern of improvement aligns closely with previously reported outcomes, where BCVA enhancements of similar magnitude were observed over comparable time intervals (14). These results reinforce the clinical utility of argon laser in promoting early anatomical and functional recovery in chronic CSCR, particularly in settings where access to newer laser technologies may be limited. The therapeutic effect of laser photocoagulation is primarily attributed to sealing of the retinal pigment epithelium (RPE) defect and enhancing the pump function of adjacent RPE cells through localized thermal stimulation (15,16). Clinical trials comparing focal laser to observation have consistently shown accelerated resolution of neurosensory detachment (NSD) in treated eyes, typically within 8 to 10 weeks (17). However, despite this early anatomical benefit, the final visual acuity outcomes and recurrence rates have remained comparable between laser-treated and untreated groups in long-term studies (18). Some studies have reported no statistically significant reduction in recurrence rates following laser therapy, with the exception of a few where reduced recurrence was observed over prolonged follow-up periods exceeding four years (17-19). These inconsistencies underscore the need for individualized treatment decisions and caution against assuming long-term superiority of laser over conservative management in all patients.

In the present study, stratified analysis revealed that age, gender, disease duration, and laterality had no significant independent effect on the visual outcomes following argon laser treatment. This uniformity suggests that laser therapy can be equally effective across diverse demographic and clinical subgroups, provided the indications and procedural parameters are appropriately adhered to. The

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strength of this study lies in its structured follow-up, standardized laser application, and focused patient selection, targeting those with persistent CSCR beyond six months and clear leakage sites on imaging. Nonetheless, the study is not without limitations. The short follow-up period of 12 weeks precluded assessment of long-term visual stability, recurrence rates, and the durability of treatment effects. Additionally, the lack of a control group receiving either placebo or alternative treatment modalities restricts the ability to compare outcomes across different therapeutic options. The exclusive use of argon laser also limits extrapolation to newer, potentially safer and more targeted techniques such as subthreshold micropulse laser or photodynamic therapy, both of which have shown promising short-term efficacy in recent literature (20). Histological evidence has also suggested that argon laser may cause more extensive retinal damage compared to diode lasers, which are capable of penetrating deeper choroidal layers, possibly offering more comprehensive treatment of the underlying choroidopathy in CSCR (18–21).

Another consideration is the natural course of CSCR, which in most cases resolves spontaneously with good visual prognosis. In untreated cohorts, final vision has been reported to return to 6/9 or better within three to six months, though the recurrence rate may be as high as 45% (22). Therefore, while laser may expedite recovery, it does not guarantee superior final vision nor eliminate the risk of recurrence. This raises a clinical debate regarding the timing and necessity of intervention, especially in first-episode or less severe presentations. Future research should focus on randomized controlled trials with longer follow-up durations comparing argon laser to modern subthreshold and diode-based laser systems. Further studies should also explore the molecular and imaging biomarkers predictive of response to laser treatment, which could allow for better patient selection and personalized therapy. Longitudinal data on recurrence, chronicity-related complications, and visual function beyond acuity alone—such as contrast sensitivity and patient-reported visual quality—are essential to comprehensively evaluate treatment outcomes in CSCR.

CONCLUSION

This study concluded that argon laser photocoagulation is an effective therapeutic option for improving best corrected visual acuity in patients with chronic central serous chorioretinopathy. The findings highlight its practical value in facilitating early visual recovery and potentially minimizing the risk of long-term functional impairment. Given its consistent benefits across varied patient profiles, the use of argon laser can be considered a valuable intervention in the management of chronic cases. Incorporating this treatment approach into routine clinical practice may contribute to better visual outcomes and improved patient satisfaction in settings where access to advanced modalities is limited.

AUTHOR CONTRIBUTION

Author	Contribution
Mubashir Nasir*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Ahsen	Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing Has given Final Approval of the version to be published
Syed Jahanzaib Naqvi	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Sabahat Aslam	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Fatima Rauf	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published

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