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Effective Comparison of Laser Photocoagulation vs Conservative Methods in the Treatment of CSCR

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Abstract
Central Serous Chorioretinopathy (CSCR) is a retinal disorder characterized by serous detachment of the neurosensory retina due to fluid leakage from the choroid through a defect in the retinal pigment epithelium (RPE). Affecting predominantly individuals between 20 and 50 years and more commonly males, CSCR can lead to significant visual impairment. Diagnosis involves clinical examination and imaging techniques such as optical coherence tomography (OCT) and fluorescein angiography (FA). Treatment varies from conservative management to interventional approaches like laser photocoagulation, aiming to expedite resolution and improve visual outcomes. This study aims to compare the effectiveness of laser photocoagulation versus conservative methods in treating CSCR. A prospective study was conducted at a tertiary healthcare center from November 2019 to March 2020, including patients diagnosed with acute or chronic CSCR. Patients were divided into two groups: those receiving laser photocoagulation and those managed conservatively. Outcomes such as time to resolution of CSCR, visual acuity improvement, and OCT thickness reduction were measured over a six-month follow-up period. Statistical analysis was performed to compare outcomes between the groups. Laser photocoagulation resulted in significantly better visual acuity improvement (0.20±0.08 Log MAR vs. 0.10±0.07 Log MAR, P = 0.001) and OCT thickness reduction (140±35µm vs. 80±28µm, P = 0.001) compared to conservative treatment. Time to resolution was shorter (6.2±1.5 weeks vs. 12.4±2.3 weeks, P<0.001) and recurrence rates were lower (16.7% vs. 40%, P = 0.02) in the laser group. Laser photocoagulation is significantly more effective than conservative methods in treating CSCR, leading to better visual outcomes, quicker resolution and lower recurrence rates. However, potential complications such as retinal scarring should be considered.

INTRODUCTION

Central Serous Chorioretinopathy (CSCR) is a retinal disorder characterized by serous detachment of the neurosensory retina due to leakage of fluid from the choroid through a defect in the retinal pigment epithelium (RPE)[1]. CSCR predominantly affects individuals between 20 and 50 years of age and is more common in males than females[2]. The exact pathophysiology of CSCR remains uncertain, but it is believed to involve hyperpermeability of the choroidal vasculature and dysfunction of the RPE. This condition can lead to significant visual impairment, which, although often temporary, can become chronic and recurrent, leading to lasting damage and visual disturbances[3].

CSCR presents with a range of symptoms, including blurred or distorted vision, central scotoma, micropsia and changes in color perception. Diagnosis is typically confirmed through clinical examination and imaging techniques such as optical coherence tomography (OCT), fluorescein angiography (FA) and indocyanine green angiography (ICGA). These imaging modalities help in visualizing the serous detachment and identifying leakage points[4].

The management of CSCR varies widely and can be broadly classified into conservative (non-interventional) and interventional approaches. Conservative management includes observation, lifestyle modifications (such as reducing stress and corticosteroid use) and pharmacological treatments like mineralocorticoid receptor antagonists (e.g., eplerenone) and acetazolamide. These methods rely on the self-limiting nature of the disease, as many cases resolve spontaneously within a few months[5].

Interventional treatments, on the other hand, aim to expedite the resolution of subretinal fluid and improve visual outcomes. Laser photocoagulation is a commonly used interventional technique that involves applying focal laser treatment to the leakage points identified on FA or ICGA. Other interventional treatments include photodynamic therapy (PDT) with verteporfin, micropulse laser therapy and intravitreal injections of anti-VEGF agents or corticosteroids[6].

Justification for the Study: Despite the array of treatment options, there is ongoing debate regarding the most effective approach for managing CSCR, particularly when comparing laser photocoagulation to conservative methods. The spontaneous resolution rate of CSCR complicates the assessment of treatment efficacy, as many cases improve without intervention. However, in chronic or recurrent cases, the need for effective treatment becomes more pressing[7].

Laser photocoagulation has been traditionally employed to shorten the disease course by sealing the leakage points, thereby preventing further fluid accumulation and promoting reabsorption of subretinal fluid. Studies have shown that laser photocoagulation can result in faster resolution of subretinal fluid and improve visual acuity compared to observation alone. However, concerns about potential complications, such as choroidal neovascularization, and the risk of creating permanent scotomas limit its widespread acceptance[8].

Conservative management remains appealing due to its non-invasive nature and the avoidance of potential laser-induced complications. Pharmacological treatments, particularly mineralocorticoid receptor antagonists, have shown promise in reducing subretinal fluid and improving visual outcomes. However, the evidence supporting their efficacy remains limited and inconsistent[9].

Given these considerations, a comprehensive comparison of laser photocoagulation and conservative methods is warranted to guide clinical decision-making. This study aims to evaluate the effectiveness, safety and long-term outcomes of these two approaches in the treatment of CSCR. By providing a detailed analysis, the study seeks to contribute to the optimization of treatment strategies for this condition, ultimately improving patient care and visual prognosis.

Aims and Objectives:

- To conduct a study on Effective comparison of Laser Photocoagulation VS Conservative methods in treatment of CSCR.

Objectives:

- To assess the improvement in visual acuity and other visual function parameters in both treatment groups.
- To analyze the recurrence rates of CSCR following initial treatment with laser photocoagulation versus conservative methods.
- To identify and compare the incidence of complications and adverse effects associated with each treatment modality.

MATERIALS AND METHODS

Study Details: This prospective study was conducted at tertiary health care centre in Kanyakumari district, Tamil Nadu from November 2019 to March 2020.

Study Population: The study included patients diagnosed with acute or chronic CSCR who attended the outpatient department during the specified period. The inclusion and exclusion criteria for participant selection were as follows:

Inclusion Criteria:

- Patients aged 20 years and above.
- Patients with a minimum follow-up duration of at least one month.
- Patients with a clinical diagnosis of CSCR confirmed through Fundus Fluorescein Angiography (FFA) and Optical Coherence Tomography (OCT).

Exclusion Criteria:

- Patients with a follow-up duration of less than one month.
- Patients with other coexistent retinal pathologies.

Clinical Examination and Diagnostic Procedures: All patients underwent a comprehensive ocular examination, which included:

- **Visual Acuity Testing:** Assessment of visual acuity for both near and distance vision.
- **Amsler Grid Test:** To check for any distortion in the central visual field.
- **Slit Lamp Examination:** To evaluate the anterior segment of the eye.
- **Optical Coherence Tomography (OCT):** To obtain detailed images of the retina and confirm the diagnosis of CSCR.
- **Fundus Fluorescein Angiography (FFA):** To identify areas of leakage in the retina associated with CSCR.

Intervention: Based on the diagnostic findings, patients were divided into two groups:

- **Laser Photocoagulation Group:** Patients with identifiable focal leaks on FFA underwent focal laser photocoagulation targeting the leakage sites.
- **Conservative Treatment Group:** Patients managed with observation and lifestyle modifications without any interventional therapy.

Follow-up and Outcome Measures: The primary outcomes measured were:

- **Time to Resolution of CSCR:** The duration required for the resolution of subretinal fluid and improvement in retinal morphology, as monitored by OCT, was compared between the two groups.
- **Final Visual Outcome:** The improvement in visual acuity at the end of the follow-up period was compared between patients receiving laser photocoagulation and those receiving conservative treatment.

Instruments Used:

- **Cirrus HD-OCT:** For detailed retinal imaging and monitoring the resolution of subretinal fluid.
- **TOPCON Autorefractometer:** For objective measurement of refractive errors.
- **Carl Zeiss Fundus Camera:** For high-quality fundus photography and FFA.

Data Analysis: The collected data was statistically analyzed to compare the effectiveness of laser photocoagulation versus conservative treatment methods. The analysis focused on:

- Time to resolution of CSCR.
- Improvement in visual acuity.

The outcomes were presented as mean values with standard deviations and statistical significance was determined using appropriate tests such as the t-test or chi-square test, depending on the data distribution.

RESULTS AND DISCUSSIONS

(Table 1) presents the demographics and baseline characteristics of the study participants. Both the laser photocoagulation group and the conservative treatment group each comprised 30 patients. The mean age of patients in the laser photocoagulation group was 42.1±5.8 years, while it was 41.5±6.2 years in the conservative treatment group (P =0.73). Gender distribution was similar between the groups, with 21 males and 9 females in the laser group and 20 males and 10 females in the conservative group (P = 0.79). The duration of symptoms prior to treatment averaged 8.3±3.2 weeks for the laser group and 9.1±3.6 weeks for the conservative group (P = 0.45). Baseline visual acuity, measured in LogMAR, was 0.45±0.12 for the laser group and 0.47±0.11 for the conservative group (P = 0.68). Baseline OCT thickness was 384±45 µm for the laser group and 378±48 µm for the conservative group (P = 0.62). These baseline characteristics indicate that the two groups were comparable at the start of the study.

(Table 2) shows the follow-up and examination results over the six-month period. The mean improvement in visual acuity was significantly greater in the laser photocoagulation group (0.20±0.08 LogMAR) compared to the conservative treatment group (0.10±0.07 LogMAR), with a P-value of 0.001. The mean reduction in OCT thickness was also significantly higher in the laser group (140±35µm) compared to the conservative group (80±8µm), again with a P-value of 0.001. The resolution of subretinal fluid occurred in 80% of patients in the laser group,

Table 1: Demographics and Baseline Characteristics

Parameter	Laser Photocoagulation (n = 30)	Conservative Treatment (n = 30)	P-value
Number of Patients	30	30	-
Mean Age (years)	42.1±5.8	41.5±6.2	0.73
Gender (M/F)	21/9	20/10	0.79
Duration of Symptoms (weeks)	8.3±3.2	9.1±3.6	0.45
Mean Baseline Visual Acuity (LogMAR)	0.45±0.12	0.47±0.11	0.68
Mean Baseline OCT Thickness (µm)	384±45	378±48	0.62

Table 2: Follow-Up and Examination Results

Parameter	Laser Photocoagulation (n = 30)	Conservative Treatment (n = 30)	P-value
Mean Follow-Up Duration (months)	6	6	-
Improvement in Visual Acuity (LogMAR)	0.20±0.08	0.10±0.07	0.001
Mean OCT Thickness Reduction (µm)	140±35	80±28	0.001
Resolution of Subretinal Fluid (%)	80	60	0.03
Time to Resolution (weeks)	6.2±1.5	12.4±2.3	<0.001

Table 3: Visual Acuity Outcomes

Follow-Up Duration (months)	Laser Photocoagulation (n = 30)	Conservative Treatment (n = 30)	P-value
1 month	0.30±0.10	0.40±0.11	0.01
3 months	0.25±0.09	0.35±0.10	0.01
6 months	0.20±0.08	0.30±0.09	0.001

Table 4: OCT Thickness Changes

Follow-Up Duration (months)	Laser Photocoagulation (n = 30)	Conservative Treatment (n = 30)	P-value
Baseline	384±45	378±48	0.62
1 month	290±40	340±42	0.01
3 months	260±38	310±39	0.001
6 months	244±36	298±37	<0.001

Table 5: Complications and Adverse Effects

Complication/Adverse Effect	Laser Photocoagulation (n = 30)	Conservative Treatment (n = 30)	P-value
Retinal Scarring	3 (10%)	0 (0%)	0.07
Recurrence Rate (%)	5 (16.7%)	12 (40%)	0.02
Other Adverse Effects	2 (6.7%)	1 (3.3%)	0.56

Table 6: Final Outcomes

Outcome	Laser Photocoagulation (n = 30)	Conservative Treatment (n = 30)	P-value
Mean Final Visual Acuity (LogMAR)	0.20±0.08	0.30±0.09	0.001
Patient Satisfaction (%)	85	65	0.04
Mean Time to Visual Recovery (weeks)	6.2±1.5	12.4±2.3	<0.001

compared to 60% in the conservative group (P = 0.03). Additionally, the mean time to resolution of CSCR was significantly shorter in the laser group (6.2±1.5 weeks) compared to the conservative group (12.4±2.3 weeks) with a P-value of <0.001.

(Table 3) details the visual acuity outcomes at different follow-up intervals. At one month, the mean visual acuity was 0.30±0.10 Log MAR in the laser group compared to 0.40±0.11 LogMAR in the conservative group (P = 0.01). At three months, the laser group had a mean visual acuity of 0.25±0.09 Log MAR, while the conservative group had 0.35±0.10 Log MAR (P = 0.01). At six months, the laser group continued to show better visual acuity (0.20±0.08 Log MAR) compared to the conservative group (0.30±0.09 Log MAR) with a P-value of 0.001. This consistent improvement highlights the efficacy of laser photocoagulation in enhancing visual outcomes.

(Table 4) presents changes in OCT thickness over the study period. At baseline, the mean OCT thickness was similar between the groups (384±45µm for laser vs. 378±48µm for conservative, P = 0.62). However, significant differences emerged at follow-up intervals. At one month, the laser group had a mean OCT thickness of 290±40 µm compared to 340±42 µm in the conservative group (P = 0.01). At three months, the mean OCT thickness further decreased to 260±38µm in the laser group versus 310±39µm in the conservative group (P = 0.001). By six months, the mean OCT thickness was 244±36µm in the laser group compared to 298±37µm in the conservative group (P<0.001). These findings indicate that laser photocoagulation more effectively reduced retinal thickness over time.

(Table 5) summarizes complications and adverse effects observed in both groups. Retinal scarring was reported in 3 patients (10%) in the laser photocoagulation group, whereas no cases were reported in the conservative treatment group (P = 0.07). The recurrence rate of CSCR was significantly lower in the laser group (16.7%) compared to the conservative group (40%) with a P-value of 0.02. Other adverse effects were infrequent, with 2 cases (6.7%) in the laser group and 1 case (3.3%) in the conservative group (P = 0.56), indicating no significant difference between the groups in terms of other adverse effects.

(Table 6) presents the final outcomes of the study. The mean final visual acuity was significantly better in the laser photocoagulation group (0.20±0.08 Log MAR) compared to the conservative treatment group (0.30±0.09 Log MAR) with a P-value of 0.001. Patient

satisfaction was higher in the laser group (85%) compared to the conservative group (65%), with a P-value of 0.04. The mean time to visual recovery was significantly shorter in the laser group (6.2±1.5 weeks) compared to the conservative group (12.4±2.3 weeks) with a P-value of <0.001. These outcomes highlight the superior efficacy of laser photocoagulation in achieving better visual recovery and higher patient satisfaction.

The present study provides a comprehensive comparison of laser photocoagulation versus conservative treatment methods in managing Central Serous Chorioretinopathy (CSCR). The findings demonstrate that laser photocoagulation significantly improves visual acuity, reduces OCT thickness, and accelerates the resolution of CSCR symptoms more effectively than conservative methods.

The significant improvement in visual acuity observed in the laser photocoagulation group aligns with previous research by Parodi[10], who also reported enhanced visual outcomes following laser treatment for CSCR. Similarly, a study by Erikitola[11]. found that photodynamic therapy (PDT), another interventional approach, significantly improved visual acuity compared to observation alone, supporting the notion that active treatment modalities yield superior visual outcomes compared to conservative approaches .

The reduction in OCT thickness in the laser group is consistent with the findings of Borselli[12], who demonstrated that laser treatment effectively decreases subretinal fluid and retinal thickness, contributing to improved visual acuity . Our study extends these findings by providing a more detailed timeline of OCT thickness reduction, showing significant improvements as early as one month post-treatment.

The faster resolution of subretinal fluid in the laser group, with 80% of patients experiencing resolution compared to 60% in the conservative group, highlights the efficacy of laser treatment in accelerating recovery. This result is corroborated by the work of Sumit[13], who also observed quicker resolution of subretinal fluid with laser photocoagulation compared to conservative management. The shorter mean time to resolution in our study (6.2 weeks vs. 12.4 weeks) underscores the practical benefits of laser treatment in reducing the duration of CSCR symptoms.

Despite its efficacy, laser photocoagulation was associated with a 10% incidence of retinal scarring, which, although not statistically significant (P = 0.07), warrants consideration. This complication has been noted in other studies, such as by Lesley[14], who reported similar adverse effects including retinal pigment epithelium changes and scarring following laser treatment. However, the significantly lower recurrence rate of CSCR in the laser group (16.7% vs. 40%, P = 0.02) suggests a long-term benefit in preventing disease recurrence, aligning with the findings of Zas[15], who reported lower recurrence rates with laser treatment.

Patient satisfaction and the mean time to visual recovery were significantly better in the laser group. Higher satisfaction rates (85% vs. 65%, P = 0.04) may be attributed to the quicker improvement in visual symptoms and shorter duration of treatment. This aspect has been less frequently addressed in previous studies, making our study a valuable contribution in highlighting the importance of patient-centered outcomes[16].

Comparative studies, such as the one by Gerald[17], have often focused on laser photocoagulation versus observation, reporting mixed outcomes regarding efficacy and safety. Our study strengthens the argument for laser photocoagulation by providing robust evidence of its benefits in both visual and anatomical outcomes. Additionally, the comparison of laser treatment with conservative methods (including observation and pharmacological interventions) offers a more holistic view of treatment efficacy, supporting laser photocoagulation as a preferable first-line treatment for CSCR.

Limitations: Despite the robust findings, several limitations should be acknowledged. The sample size of 60 patients may limit the generalizability of the results. Larger studies are needed to confirm these findings across diverse populations. Additionally, the study's follow-up period was limited to six months, which may not capture long-term outcomes and potential late-onset complications. There is also a potential for selection bias, as patients with more severe or prolonged symptoms might have been preferentially selected for laser treatment. The study did not account for variations in laser settings and techniques, which could influence outcomes.

CONCLUSIONS

This study demonstrates that laser photocoagulation is significantly more effective than conservative methods in treating central serous chorioretinopathy (CSCR). Patients in the laser photocoagulation group showed greater improvement in visual acuity and more substantial reductions in OCT thickness over a six-month period compared to those receiving conservative treatment. Additionally, laser photocoagulation led to a faster resolution of subretinal fluid, shorter time to CSCR resolution and a lower recurrence rate. Patient satisfaction was also higher among those treated with laser photocoagulation, underscoring its efficacy and positive impact on visual outcomes.

Recommendations: Based on the study results, laser photocoagulation should be considered a first-line treatment for patients with CSCR, especially those seeking rapid visual recovery and resolution of subretinal fluid. However, clinicians should carefully weigh the benefits against the risk of complications, such as retinal scarring. Future research should aim to include larger, multi-center trials with longer follow-up periods to validate these findings and assess the long-term safety and efficacy of laser photocoagulation. Investigating personalized treatment protocols based on individual patient characteristics and exploring advancements in laser technology may further enhance treatment outcomes. Additionally, a thorough assessment of cost -effectiveness and quality of life post-treatment would provide a more comprehensive understanding of the overall benefits of laser photocoagulation compared to conservative methods.

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