Faridpur Med. Coll. J. 2025;20(1):24-28 DOI: https://doi.org/10.3329/fmcj.v20i1.80643

Original Article

Focal Laser Photocoagulation for Central Serous Chorioretinopathy, Impact on Central Macular Thickness and Total Volume in Macular Region

MM Rahman[1], M Moniruzzaman[2], AFMJ Alam[3], T Ahmed[4], FS Mou[5]

Abstract:

Central serous chorioretinopathy is an eye condition that causes visual distortion, blurring, or decreased vision. It's characterized by a serous fluid-filled detachment of the neurosensory retina in the macular area & often caused by leakage from the choroid, the layer of blood vessels beneath the retina. This study was carried out in a tertiary level referral center in Bangladesh, retrospectively evaluating patients who underwent focal laser for central serous chorioretinopathy to assess the visual and anatomical outcomes of focal laser photocoagulation for central serous chorioretinopathy and subsequent changes to central macular thickness and total volume in macular region. Baseline visual acuity, central macular thickness and total volume were recorded and calculated and compared with baseline and 4 weeks post focal laser. Data were compared using Wilcox signed-rank tests after using Shapiro-Wilk tests to determine normality. Total 25 eyes of 24 patients with central serous chorioretinopathy that underwent focal laser photocoagulation were included in this study. Patients were followed for a median of 1.5 months (range: 1.0–2.0 months) after treatment. Male and female ratio was 7:1. The visual acuity was significantly improved (0.55±0.24 to 0.87±0.21, p<0.001). The Mean Pre-laser central macular thickness was 475.24µm and the mean post-laser 177.08µm (475.24 ±196.52 µm to 177.08 ±52.55 µm, p<0.001), there was significant change. The change in total volume was significant statistically (10.3820 ±2.7169 mm3 to 7.6524 ± 0.7440 mm3, p<0.001). Of the 25 eyes, 4 had persistent sub-retinal fluid following laser, and of the 21 eyes with complete resolution of sub-retinal fluid, 2 developed recurrent sub-retinal fluid.

Key words: Central serous chorioretinopathy, Focal laser photocoagulation, Central macular thickness, Total volume in macular region, Sub-retinal fluid.

Introduction:

Central serous chorioretinopathy (CSCR) is a condition that affects the retina, specifically the macula, which is responsible for central vision. It is characterized by the accumulation of fluid beneath the retina, leading to distorted or blurry central vision. It is often self-limited, with resolution of fluid within 1-4 months[1-3]. However, about 50% of patients with an initial spontaneous fluid resolution will experience a recurrent episode by 1 year[1].

1. Dr. Md. Mizanur Rahman, MBBS, DO, Consultant (Eye), Medicare Hospital, Chapai Nawabganj. Email: muhammadmizanur2@gmail.com.
2. Dr. Muhammad Moniruzzaman, MBBS, FCPS, Consultant, Vision Eye Hospital, 229, Green road, Dhaka. Email: drmoniruzzaman83@gmail.com.
3. Dr. Abu Faisal Md. Jahangir Alam, MBBS, DO,Consultant, Vitreo-Retina, Dhaka Eye Care Hospital, Dhaka. Email: dr.faisal43@gmail.com.
4. Dr. Md. Tangil Ahmed, MBBS, MS. Assistant Professor, Kumudini Women's Medical College, Mirzapur, Tangail, Email: dr.tangilahmed@gmail.com.
5. Dr. Farzana Sultana Mou, MBBS, DO, Consultant, Vitreo-Retina, Vision Eye hospital, 229 Green road, Dhaka. Email: dr.farzanasultanamou@gmail.com

Address of correspondence:

Dr. Md. Mizanur Rahman, MBBS, DO, Consultant (Eye), Medicare Hospital, Chapai Nawabganj. Phone Number:+8801756059786 Email: muhammadmizanur2@gmail.com

Therefore, while spontaneous fluid resolution occurs frequently, recurrence or persistence of fluid is common and may require intervention to optimize visual outcome[1].

Although it was previously believed that CSCR predominantly affected white patients, more recent studies have shown that the disease is under-diagnosed in black patients[4]. While CSCR has been studied in white and some Asian populations, it has rarely been studied in Hispanic populations[5]. CSCR, first described by Albrecht von Graefe in 1866, is characterized by focal serous detachment of the neural retina and/or retinal pigment epithelium (RPE) in the posterior pole. CSCR is the first ever described pachychoroid disease[6]. Low enrollment of patients from racial and ethnic minority groups in clinical trials for eye diseases has been documented in the past, with most studies consisting of a majority of white research participants[7]. Racial and ethnic identities of included patients were collected from electronic charts[8]. The exact cause of CSCR is not fully understood, but there are several factors that may contribute to its development. These include: 1. Stress: Psychological stress or physical stressors can trigger CSCR in some individuals. 2. Hormonal factors: CSCR is more common in men than women, and hormonal changes, such as increased levels of cortisol (a stress hormone), have been associated with the condition. 3. Age: CSCR primarily affects individuals between the ages of 20 and 50, although it can occur at any age. 4. Medications: Certain medications, such as corticosteroids, can increase the risk of developing CSCR. 5. Other factors: Smoking, hypertension (high blood pressure), and Type A personality traits have also been linked to CSCR, although the relationship is not fully understood.

The most common symptom of CSCR is a sudden onset of blurred or distorted central vision in one eye. Other symptoms may include: 1. Decreased color perception. 2. Reduced contrast sensitivity. 3. Micropsia (objects appearing smaller than they actually are). 4. Metamorphopsia (straight lines appearing wavy or distorted).

Diagnosing CSCR typically involves a comprehensive eye examination, which may include the following: 1. Dilated eye examination: Examine the retina for any signs of fluid accumulation in macula or other abnormalities. 2. Optical coherence tomography (OCT): This non-invasive imaging test provides detailed cross-sectional images of the retina, allowing the doctor to assess the presence and extent of fluid accumulation. 3. Fluorescein angiography: A dye is injected into a vein in usually arm, and as it circulates through the blood vessels in the eye, photographs are taken to identify any leaks or abnormalities.

CSCR is often a self-limited process[1,9,10]. In many cases, CSCR resolves on its own within a few weeks to months without treatment. Prior investigation demonstrates spontaneous resolution of acute SRF associated with initial observation in 80–90% of patients[2]. However, in cases of persistent SRF, RPE atrophy can lead to progressive and permanent visual dysfunction[3,10]. However, if the condition persists or causes significant vision problems, treatment options may include: 1. Observation, 2. Oral Eplerenone, 3. Photodynamic therapy, 4. Anti-vascular endothelial growth factor (anti-VEGF) injections and 5. Focal laser photocoagulation.

Focal laser treatment is typically considered when identify any leaking point of the CSCR that persists for several days or months if the fluid accumulates beneath the central macula (the area responsible for sharp, central vision). YAG laser used to deliver small, precise bursts of laser energy to the area of leakage identified on fluorescein angiography. The laser creates a tiny burn or scar, which helps to seal the leak and reduce fluid accumulation. After the procedure, patients may experience some mild discomfort or blurred vision for a few days which can be treated with topical nonsteroidal anti-inflammatory drug. Additional laser treatments may be required if the leakage persists or recurs.

Aim of the study was to evaluate the effectiveness of laser photocoagulation in the treatment of central serous chorioretinopathy (CSCR) and associated changes on Central Macular Thickness (CMT) and Total Volume in Macular Region (TV).

Materials and Methods:

This cross-sectional study was conducted at Vision Eye Hospital, Dhaka, from January 2023 to March 2024. The study included 25 eyes of 24 patients diagnosed with CSCR. Patients having CSCR with one to three leakage points were included in this study. Patients having CSCR with no identifiable leakage point or having more than three leakage points were excluded from the study.

All participants underwent a comprehensive ophthalmologic examination, including Amsler grid testing, dilated fundus examination, and optical coherence tomography (OCT) of the macula and Fundus fluorescein angiography (FFA). Following confirmation of CSCR, selected patients underwent focal laser photocoagulation. Follow-up examinations, including repeat OCT macula, were performed 1-2 months post-treatment, and pre- and post-treatment OCT data were compared. Data were visualized using bar graphs

and pie charts generated via the NCES Kids' Zone online graphing tool (https://nces.ed.gov/nceskids/ graphing/ classic/pie.asp). Statistical analysis was performed using-the Wilcoxon signed-rank test, a non-parametric statistical test used to compare two related samples, matched samples, or repeated measurements on a single sample. It is often used as an alternative to the paired t-test when the data cannot be assumed to be normally distributed and online t-test calculator (https://www.graphpad.com/quickcalcs/ttest1/).

Results:

This study evaluated the effectiveness of laser photocoagulation in treating central serous chorioretinopathy (CSCR), revealing a striking gender disparity with a male to female ratio of 7:1 (Figure 1).

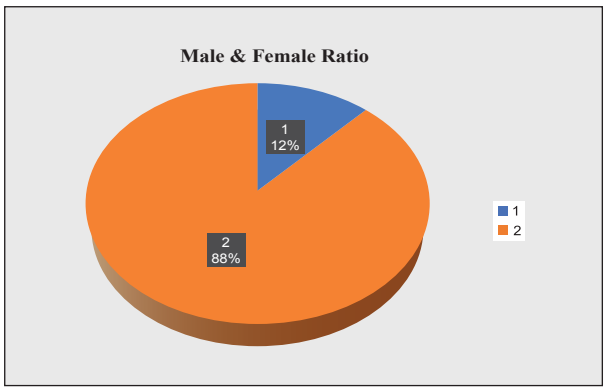

Figure-1: Male & female ratio among patients

Visual acuity is measured by logmar Visual Acuity chart. Visual acuity demonstrated a statistically significant improvement following treatment, increasing from a mean of 0.55 ± 0.24 to 0.87 ± 0.21 ($p<0.001$) (Figure 2).

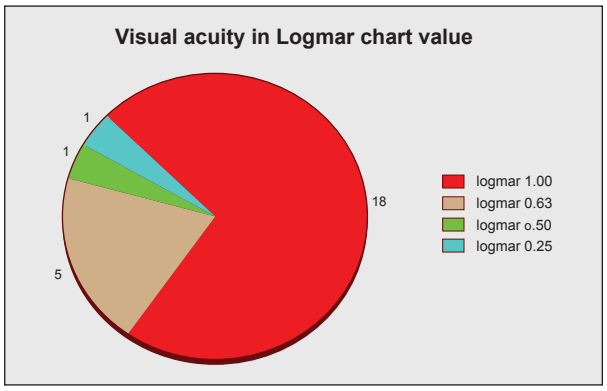

Figure-2: Best corrected visual acuity improvement after focal laser treatment

Macula OCT eye test is a noninvasive imaging test that produces detailed images of the retina. With OCT ophthalmologists can see each of the retina's distinctive layers and map and measure their thickness, which helps with diagnosis and guides treatment for retinal disease. This table shows comparison between OCT macula before and after focal laser photocoagulation in one CSCR patient (Figure 3).

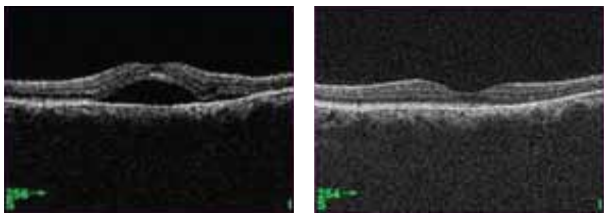

Figure-3: OCT image before (A) & after (B) focal laser photocoagulation

Correspondingly, significant anatomical improvements were observed. Mean central macular thickness (CMT) decreased dramatically from 475.24 ± 196.52 µm pre-laser to 177.08 ± 52.55 µm post-laser ($p<0.001$), indicating a substantial reduction in macular edema. Central macular thickness was measured in µm. The two-tailed P value is less than 0.0001. By conventional criteria, this difference is considered to be extremely statistically significant (Table I).

Table-I: Central macular thickness changes (Pre laser & post laser)

Group	Pre laser CMT	Post laser CMT
N	25	25
Mean	475.24	177.08
SD	196.52	52.55
SEM	39.30	10.51

[N- Number of data, SD- Standard Deviation, SEM- Standard Error of the Mean, Data analysis was done by Wilcoxon signed-rank test and online t-test calculator (https://www.graphpad.com/quickcalcs/ttest1/).]

Topcon 3d OCT-2000 Optical Coherence Tomography shows reduction in fluid accumulation was further corroborated by a statistically significant decrease in total macular volume from a mean of 10.3820 ± 2.7169 mm^3 to 7.6524 ± 0.7440 mm^3 ($p<0.001$). While the

majority of eyes (21 out of 25) achieved complete resolution of sub-retinal fluid after laser treatment, four eyes exhibited persistent sub-retinal fluid despite intervention (Table II).

Table-II: Total volume in Macular Region changes (Pre laser & post laser)

Group	Pre laser Total volume	Post laser Total volume
N	25	25
Mean	10.3820	7.6524
SD	2.7169	0.7440
SEM	0.5434	0.1488

[N- Number of data, SD- Standard Deviation, SEM- Standard Error of the Mean, Data analysis by Wilcoxon signed-rank test and online t-test calculator (https://www.graphpad.com/quickcalcs/ttest1/).]

Discussion:

Focal laser treatment aims to seal the leaking blood vessels and reduce the accumulation of fluid, thus improving visual symptoms associated with CSCR. The success rate of the treatment varies among individuals, and some may require additional interventions. In studies comparing laser photocoagulation to observation or sham lasers, patients receiving laser therapy demonstrated faster time to resolution of SRF, although laser treatment seems less effective in achieving an improvement in VA or reducing the rate of new episodes compared to treatment with PDT [3,11]. Most previous articles, however, do not report demographic breakdowns of subjects undergoing laser therapy[12-14]. Our research presents a unique perspective on focal laser treatment, demonstrating positive results in patient groups that haven't been adequately represented in previous studies. We observed significant improvements in both best-corrected visual acuity (VA) and central macular thickness (CMT), total macular volume following focal laser photocoagulation, with positive final VA outcomes in nearly all cases. We found that best-available VA and CMT significantly improved after focal laser photocoagulation, along with final VA, with the exception of one eye that developed CNVM[15]. Total macular volume changes following focal laser photocoagulation has not reported in previous study.

In a study by Sangal K et al, showed that, at baseline, mean VA was 0.36 ± 0.30 logMAR with an average CMT of 384.12 ± 132.20 µm[15]. The average best-available VA after focal laser photocoagulation was 0.16 ± 0.25 logMAR with an average CMT of 248.64 ± 68.12 µm measured at the time of best-available VA[15].

From our study at baseline, mean VA was 0.55 ± 0.24 logMAR with an average CMT of 475.24 ± 196.52 µm. The average best-available VA after focal laser photocoagulation was 0.87 ± 0.21 logMAR with an average CMT of 177.08 ± 52.55 µm measured at the time of best-available VA. Additionally baseline total volume in macular region 10.3820 ±2.7169 mm^3 and after focal laser photocoagulation total volume in macular region 7.6524 ± 0.7440 mm^3. Total volume in macular region is another parameter to measure and compare impact of Focal Laser Photocoagulation for Central Serous Chorioretinopathy.

Both studies investigated the effects of laser photocoagulation on VA and CMT, likely for conditions involving macular edema or other related pathologies. While both concluded that the treatment led to significant improvements in both parameters, there are notable differences in the reported data, likely reflecting variations in study design, patient demographics, and specific treatment protocols.

Conclusion:

Our case series demonstrates that focal laser photocoagulation is still a potential treatment option for CSCR patients who have traditionally been under-represented in prior clinical studies in others study. CMT and Total volume after focal laser on CSCR, which shows significant changes associated with resolution of the fluid and changes to the visual acuity. To study changes in CMT and Total volume after focal laser on CSCR patients, larger study numbers are required and more standardized methods of calculation must be adopted.

Conflict of interest: None.

References:

1. Nicholson B, Noble J, Forooghian F, Meyerle C. Central serous chorioretinopathy: update on pathophysiology and treatment. *Surv Ophthalmol*. 2013 Mar;58(2):103–26.

2. Burumcek E, Mudun A, Karacorlu S, Arslan MO. Laser photocoagulation for persistent central serous retinopathy. *Ophthalmology*. 1997 Apr;104(4):616–22.

3. Iacono P, Battaglia PM, Falcomatà B, Bandello F. Central serous chorioretinopathy treatments: a mini review. *Ophthalmic Res*. 2015 Dec 1;55(2):76–83.

4. Desai UR, Alhalel AA, Campen TJ, Schiffman RM, Edwards PA, Jacobsen GR. Central serous chorioretinopathy in African Americans. *J Natl Med Assoc*. 2003 Jul 1 [cited 2022 Jan 19];95(7):553–9.

5. Kumawat D, Ravi AK, Sahay P, Alam T, Desai A, Kumar A. Systemic evaluation of patients with central serous chorioretinopathy: a case-control study. *Eur J Ophthalmol*. 2021 Nov 25;31(6):3223–30.

6. Zhang X, Lim CZF, Chhablani J, Wong YM. Central serous chorioretinopathy: updates in the pathogenesis, diagnosis and therapeutic strategies. *Eye Vis (Lond)*. 2023 Jul 11;10(1):33. doi: 10.1186/s40662-023-00349-y. PMI D: 37430344; PMCID: PMC10334588.

7. Hamid M, Orlov S, De Lott L, Ling JJ, Woodward MA. Reporting and enrollment of women and racial minorities in ophthalmic clinical trials. *Invest Ophthalmol Vis Sci*. 2019 Jul 22;60(9):5469.

8. Holladay JT. Visual acuity measurements. *J Cataract Refract Surg*. 2004 Feb;30(2):287–90.

9. Klein ML, van Buskirk EM, Friedman E, Gragoudas E, Chandra S. Experience with nontreatment of central serous choroidopathy. *Arch Ophthalmol*. 1974 Apr 1;91 (4):247–50.

10. Hanumunthadu D, Tan AS, Singh S, Sahu N, Chhablani J. Management of chronic central serous chorioretinopathy. *Indian J Ophthalmol*. 2018;66(12):1704.

11. Park YJ, Kim YK, Park KH, Woo SJ. Long-term efficacy and safety of photodynamic therapy in patients with chronic central serous chorioretinopathy. *Ophthalmic Surg Lasers Imaging Retina*. 2019 Dec 1 [cited 2022 Jul 21];50(12):760–70. Available from: https://pubmed-ncbi-nlm-nih-gov.ezproxy.bu.edu/31877221/.

12. Ficker L, Vafidis G, While A, Leaver P. Long-term follow-up of a prospective trial of argon laser photocoagulation in the treatment of central serous retinopathy. *Br J Ophthalmol*. 1988 [cited 2022 Jan 19];72(11): 829–34. Available from: https://pubmed.ncbi.nlm.nih.gov/3061449/.

13. Müller B, Tatsios J, Klonner J, Pilger D, Joussen AM. Navigated laser photocoagulation in patients with nonresolving and chronic central serous chorioretinopathy. Graefes *Arch Clin Exp Ophthalmol*. 2018 Sep 1 [cited 2022 Jul 6];256(9):1581–8. Graefe's archive for clinical and experimental ophthalmology = Albrecht von Graefes Archiv fur klinische und experimentelle Ophthalmologie. https://pubmed-ncbi-nlm -nih-gov.ezproxy. bu.edu/29876 733/.

14. Ambiya V, Khodani M, Goud A, Narayanan R, Tyagi M, Rani PK, et al. Early focal laser photocoagulation in acute central serous chorioretinopathy: a prospective, randomized study. *Ophthalmic Surg Lasers Imaging Retina*. 2017 Jul; 48(7):564–71.

15. Sangal K, Prasad M, Siegel NH, Chen X, Ness S, Subramanian ML. Focal Laser Photocoagulation for Central Serous Chorioretinopathy in Under-Represented Populations: A Retrospective *Case Series. Case Reports in Ophthalmology*.2022;13(3):1000-1007 DOI:10.1159/000 527439 LicenseCC BY-NC 4.0.