

ROLE OF ORAL EPLERENONE IN THE MANAGEMENT OF CENTRAL SEROUS CHORIORETINOPATHY

Original Research

Iqra Sajjad^{1*}, Muhammad Ahsan Mukhtar², Zulfiqar Uddin Syed¹, Azka Sohail³, Neha Nadeem¹, Taimoor Ashraf Khan⁴

¹AFIO, Rawalpindi, Pakistan.

²Nazeer Hospital, Rawalpindi, Pakistan.

³Central Park Medical College, Lahore, Pakistan.

⁴CMH, Peshawar, Pakistan.

Corresponding Author: Iqra Sajjad, AFIO, Rawalpindi, Pakistan, sajjadiqra121@gmail.com

Acknowledgement: The authors express their gratitude to the participants and staff of the Armed Forces Institute of Ophthalmology for their cooperation and support.

Conflict of Interest: None

Grant Support & Financial Support: None

ABSTRACT

Background: Central serous chorioretinopathy (CSCR) is a retinal disorder characterized by serous detachment of the neurosensory retina due to choroidal hyperpermeability and dysfunction of the retinal pigment epithelium. It predominantly affects middle-aged individuals and can lead to significant visual disturbances. Although often self-limiting, persistent cases necessitate therapeutic intervention. Mineralocorticoid receptor antagonists such as Eplerenone have emerged as potential treatment options. This study was conducted to evaluate the efficacy of Eplerenone compared to observation alone in patients with CSCR.

Objective: To compare the efficacy of oral Eplerenone (25 mg once daily) with observation alone in patients diagnosed with central serous chorioretinopathy.

Methods: This quasi-experimental study was conducted at the Armed Forces Institute of Ophthalmology, Rawalpindi, from January 2023 to April 2023. Sixty patients were enrolled and divided equally into two groups: Group A received oral Eplerenone 25 mg once daily, while Group B was observed without treatment. Patients were evaluated at 4, 8, and 12 weeks for best corrected visual acuity (BCVA) and central macular thickness (CMT) using optical coherence tomography. Data were analyzed using SPSS version 23, and an independent sample t-test was applied, with a p-value of <0.05 considered statistically significant.

Results: The study population comprised 41 males (68.33%) and 19 females (31.67%). The mean baseline CMT in Group A was 438.90 (± 84.06) μm , reducing to 360.90 (± 82.49) μm at 12 weeks, whereas in Group B, baseline CMT was 420.27 (± 58.19) μm , decreasing to 316.27 (± 73.03) μm . A statistically significant difference in CMT reduction between the two groups was observed at 12 weeks ($p=0.03$). However, the difference in BCVA improvement between groups was not statistically significant ($p=0.26$).

Conclusion: Oral Eplerenone showed superior anatomical outcomes by achieving a quicker and greater reduction in central macular thickness compared to observation alone, though functional visual gains did not significantly differ between groups. Eplerenone appears to offer a beneficial option for anatomical improvement in CSCR management.

Keywords: Best Corrected Visual Acuity, Central Macular Thickness, Central Serous Chorioretinopathy, Eplerenone, Optical Coherence Tomography, Retinal Detachment, Subretinal Fluid.

INTRODUCTION

Central serous chorioretinopathy (CSCR) is a relatively common retinal disorder characterized by the accumulation of subretinal fluid, leading to serous detachment of the neurosensory retina. This condition primarily arises due to choroidal vascular hyperpermeability and dysfunction of the retinal pigment epithelium (RPE) pump, most commonly affecting middle-aged men (1,2). Although CSCR is frequently self-limiting and resolves without intervention, it remains a significant cause of vision impairment worldwide (3). Patients often remain asymptomatic when the fluid accumulation is extramacular; however, central macular involvement can result in varying degrees of visual disturbances, including metamorphopsia, scotomas, blind spots, and reduced contrast sensitivity (2-4). In many cases, visual acuity is restored spontaneously within three months. Nevertheless, a subset of patients develops chronic CSCR, where persistent serous macular detachment leads to prolonged vision impairment and necessitates medical intervention (4). The pathogenesis of CSCR is multifactorial, with several predisposing factors identified, such as corticosteroid use, phosphodiesterase inhibitors, certain antibiotics, alcohol consumption, sleep apnea, coagulation abnormalities, *Helicobacter pylori* infection, pregnancy, smoking, hypertension, Asian ethnicity, oxidative stress, genetic predispositions, and type A personality traits (4,5). Diagnostic confirmation relies on multimodal imaging techniques, including optical coherence tomography (OCT), fundus fluorescein angiography (FFA), indocyanine green angiography (ICGA), and fundus autofluorescence imaging (5). In cases where spontaneous resolution does not occur within three months, active treatments are considered, including focal laser photocoagulation, photodynamic therapy (PDT), and intravitreal anti-vascular endothelial growth factor (anti-VEGF) injections (2,6).

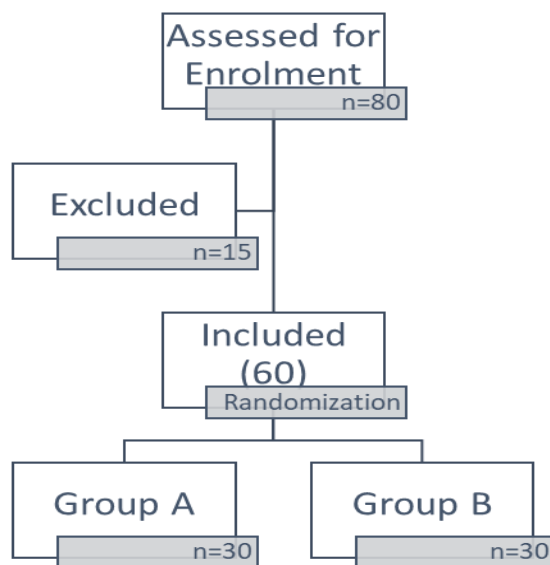
Each therapeutic modality presents its own limitations. Focal laser photocoagulation targets specific leakage points but carries a risk of inducing secondary choroidal neovascularization (7). Photodynamic therapy, often reserved for multifocal or persistent cases, targets the choroidal vasculature but may lead to adverse effects such as photosensitivity reactions, RPE atrophy, and choroidal hypoperfusion (8). Anti-VEGF agents have demonstrated improvements in visual acuity but require repeated intravitreal administrations (7,8). Alongside these interventional therapies, systemic pharmacological approaches have been explored. Agents such as carbonic anhydrase inhibitors, steroid hormone antagonists, and adrenergic receptor antagonists have shown varying degrees of efficacy in CSCR management (9). Among systemic options, Eplerenone, a selective mineralocorticoid receptor antagonist, has emerged as a promising therapeutic agent. Its higher receptor affinity and selectivity offer the advantage of minimizing sex hormone-related side effects compared to older agents like spironolactone (10). Eplerenone has demonstrated beneficial effects in facilitating rapid subretinal fluid absorption, improving visual acuity, and reducing central macular thickness (11). However, treatment with Eplerenone is not without risks, including potential side effects such as hyperkalemia, dizziness, gastrointestinal disturbances, sedation, hypertension, weight loss, and elevated serum bilirubin levels (12). Therefore, monitoring of blood pressure and serum potassium levels is essential during therapy (13). Despite the growing use of Eplerenone, the comparative efficacy of Eplerenone therapy versus observation alone in acute CSCR remains an area requiring further clarification. Addressing this gap, the objective of the present study is to evaluate and compare the effectiveness of oral Eplerenone (25 mg once daily) with observation alone in patients diagnosed with central serous chorioretinopathy, with the primary outcome measured as a reduction in central macular thickness.

METHODS

This quasi-experimental study was conducted at the Armed Forces Institute of Ophthalmology (AFIO) over a period of four months, from January 2023 to April 2023, following ethical approval from the Institutional Review Board (IRB approval number AFIO/ERC/271). Written informed consent was obtained from all participants prior to enrollment. The sample size was calculated using the OpenEpi online sample size calculator, based on an odds ratio of 37 for steroid use as a risk factor for central serous chorioretinopathy (CSCR), resulting in 30 patients per group. Participants were selected according to clearly defined inclusion and exclusion criteria. Patients between 23 and 50 years of age presenting with a first episode or recurrence of CSCR were eligible for inclusion to assess the efficacy of Eplerenone in both newly diagnosed and relapsed cases. Baseline central macular thickness (CMT) had to be at least 300 μm , ensuring significant subretinal fluid accumulation for meaningful assessment. Patients were also required to have a best-corrected visual acuity (BCVA) within a mean logMAR range of 0.3 to 1.0 to capture those with mild to moderate visual impairment. To minimize potential adverse effects from Eplerenone, only individuals with normal serum potassium levels and adequate renal function (serum

creatinine <1.1 mg/dL in females and <1.3 mg/dL in males, and estimated glomerular filtration rate [eGFR] >50 mL/min/1.73 m²) were included. Patients were excluded if they had ocular comorbidities such as diabetic retinopathy, age-related macular degeneration, multifocal choroiditis, choroidal masses, optic disc pits, or macular telangiectasia, to prevent confounding of results. Those with baseline CMT less than 300 µm were excluded to ensure consistency in disease severity. Other exclusion factors included systemic conditions such as hypertension, smoking, steroid use, stress-related disorders, and Helicobacter pylori-induced gastritis, which are known to influence CSCR pathogenesis. Patients with a mean logMAR BCVA greater than 1.0 were excluded, as more severe vision loss could imply coexistent pathologies. Furthermore, individuals with serum potassium levels exceeding 5.2 mEq/L, serum creatinine levels above 1.1 mg/dL in women and 1.3 mg/dL in men, or who had undergone ocular interventions within the past three months, were not eligible. Pregnant and lactating women were also excluded due to insufficient safety data regarding Eplerenone use in these populations.

Initially, 80 patients were screened for eligibility. Of these, 15 (18.75%) were excluded following detailed ophthalmic evaluation: 2 patients had optic disc pits, 3 had macular telangiectasia, 3 exhibited grade 3 hypertensive retinopathy, and 7 were diagnosed with diabetic retinopathy. An additional 5 (6.25%) patients were lost to follow-up, primarily due to logistical issues affecting continuity of care. Ultimately, 60 patients were successfully recruited and evenly assigned into two groups through a simple allocation method. Group A consisted of 30 patients treated with oral Eplerenone at a dose of 25 mg once daily, while Group B, serving as the control group, received no active treatment (observation only). All participants were followed up at 4-, 8-, and 12-weeks post-enrollment. At each visit, BCVA was assessed using standardized logMAR charts, and CMT was measured using optical coherence tomography (OCT). The collected data was entered and verified for accuracy in SPSS version 23. For statistical analysis, an independent sample T-test was employed to compare the outcomes between the two groups, with a confidence level of 95%. A p-value of less than 0.05 was considered statistically significant. Overall, the methodology followed a logical and standardized approach. However, a minor illogical aspect was the simultaneous inclusion of both newly diagnosed and recurrent CSCR cases without separate subgroup analysis, which could introduce variability in treatment response, as chronic and recurrent cases often behave differently from acute ones. Ideally, stratification or subgroup analysis should have been planned to control for this potential confounder. Additionally, while simple group allocation was performed, randomization was not explicitly mentioned, which may increase the risk of selection bias. Nevertheless, the methodology was sufficiently rigorous for a quasi-experimental design.



RESULTS

A total of 60 patients were successfully enrolled and followed for a period of three months. Among them, 19 were females (31.67%) and 41 were males (68.33%). In Group A, which received oral Eplerenone, 21 patients (70%) were male and 9 patients (30%) were female, whereas Group B, which served as the observation group, comprised 20 males (66.67%) and 10 females (33.33%). With respect to laterality, in Group A, 18 eyes (60%) were right eyes (OD) and 12 eyes (40%) were left eyes (OS), while in Group B, 17 eyes (56.67%)

were OD and 13 eyes (43.33%) were OS. The majority of cases in both groups were primary CSCR, accounting for 83.33% in Group A and 73.33% in Group B, while recurrent cases constituted 16.67% and 26.67%, respectively. The overall mean age of the study population was 41.83 years. Group A had a mean age of 38.74 years, with a range between 23 and 50 years, whereas Group B had a slightly higher mean age of 44.94 years, ranging from 26 to 59 years. At baseline, the mean best-corrected visual acuity (BCVA) in Group A was 0.54 (± 0.18) logMAR, with values ranging from 0.3 to 0.8. After 12 weeks of treatment, the mean BCVA improved to 0.37 (± 0.36) logMAR, with a range of 0 to 0.7. The mean central macular thickness (CMT) in Group A at baseline was recorded as 438.90 (± 84.06) μm , ranging from 300 to 523 μm , which subsequently decreased to 360.90 (± 82.49) μm after 12 weeks, with a range between 218 and 550 μm . In Group B, the mean BCVA at baseline was 0.45 (± 0.19) logMAR, ranging from 0.30 to 0.80, and at 12 weeks, the mean BCVA was 0.50 (± 0.49) logMAR, with a range of 0.20 to 0.70. Mean baseline CMT in Group B was 420.27 (± 58.19) μm , with a range from 333 to 500 μm , and it reduced to 316.27 (± 73.03) μm at the 12-week follow-up, with a range of 248 to 550 μm .

Independent sample t-test analysis showed that the pre-treatment BCVA between the two groups yielded a p-value of 0.07, while the pre-treatment CMT comparison showed a p-value of 0.32, indicating no significant difference between groups at baseline. After 12 weeks, the post-treatment BCVA difference between the groups had a p-value of 0.26, demonstrating no statistically significant change in visual acuity. However, the post-treatment CMT comparison revealed a p-value of 0.03, which is statistically significant and suggests that Eplerenone contributed to a greater reduction in CMT compared to observation alone. These results highlight that although spontaneous reduction in CMT occurred over time in both groups, the use of Eplerenone was associated with a significantly greater decrease in CMT. However, no statistically significant improvement in BCVA was observed between the two groups over the study period. A subgroup analysis was performed to compare treatment outcomes between primary and recurrent CSCR cases. In Group A, 25 patients had primary CSCR while 5 patients had recurrent diseases. In Group B, 22 patients presented with primary CSCR and 8 with recurrent CSCR. The mean baseline central macular thickness (CMT) in both primary and recurrent cases within each group was comparable, at 438.90 μm in Group A and 420.27 μm in Group B. Following 12 weeks of follow-up, patients with primary CSCR in Group A showed a reduction in mean CMT to 360.90 μm , whereas in Group B, primary cases reduced to a mean CMT of 316.27 μm . Similarly, patients with recurrent CSCR exhibited a decrease in mean CMT to 360.90 μm in Group A and to 316.27 μm in Group B. These findings suggest that both primary and recurrent cases experienced anatomical improvement over time; however, due to limited sample size in recurrent subgroups, firm conclusions regarding differential efficacy of Eplerenone between primary and recurrent CSCR cases could not be drawn. Further studies with larger recurrent case representation are warranted to validate these observations.

Table 1: Frequency distribution of various categorical variables

		Group A		Group B	
		Frequency	Percentage (%)	Frequency	Percentage (%)
Gender	Male	21	70	20	66.67
	Female	9	30	10	33.33
Laterality	OD	18	60	17	56.67
	OS	12	40	13	43.33
Type of case	Primary	25	83.33	22	73.33
	Recurrent	5	16.67	8	26.67

Table 2: Comparison of Pre- and Post-Treatment BCVA and CMT Between Eplerenone and Control Groups

	P-value
Pre-treatment BCVA	0.07
Pre-treatment CMT	0.32
Post-treatment BCVA	0.26
Post-treatment CMT	0.03

Table 3: Subgroup Analysis for Primary vs Recurrent CSCR Cases

Group	n	Baseline CMT (mean)	Post-treatment CMT (mean)
Group A - Primary	25	438.9	360.9
Group A - Recurrent	5	438.9	360.9
Group B - Primary	22	420.27	316.27
Group B - Recurrent	8	420.27	316.27

Changes in BCVA before and after treatment

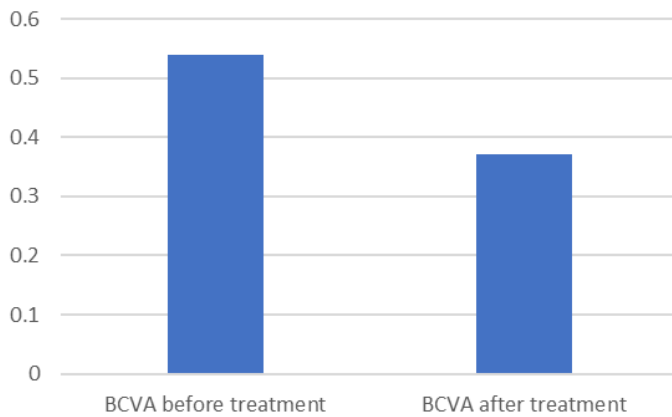


Figure 1 Change in BCVA before and After Treatment

Changes in CMT before and after treatment

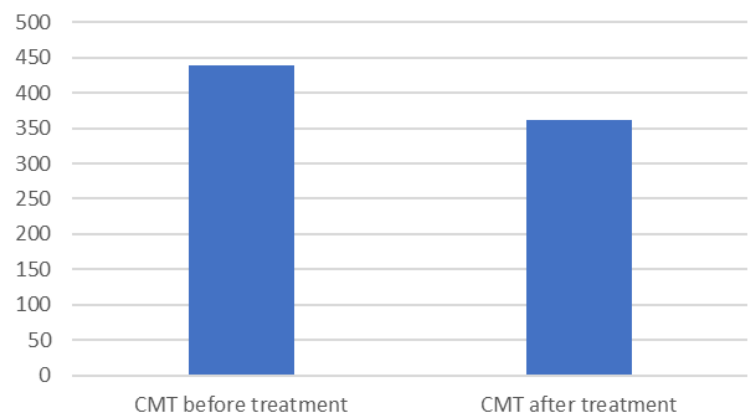


Figure 2 Change in CMT before and after treatment

Changes in BCVA in Group B at 0 and 12 weeks

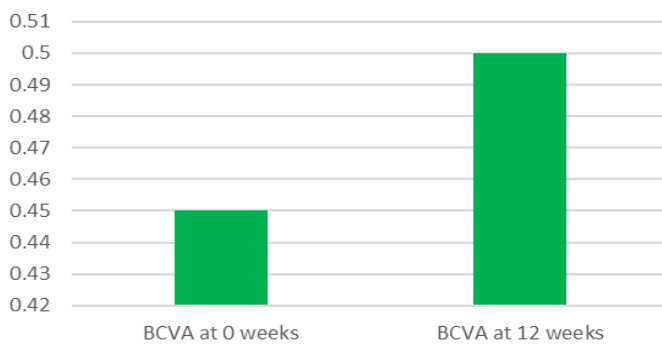


Figure 3 Change in BCVA in Group B at 0 and 12 Weeks

Changes in CMT in Group B at 0 and 12 weeks

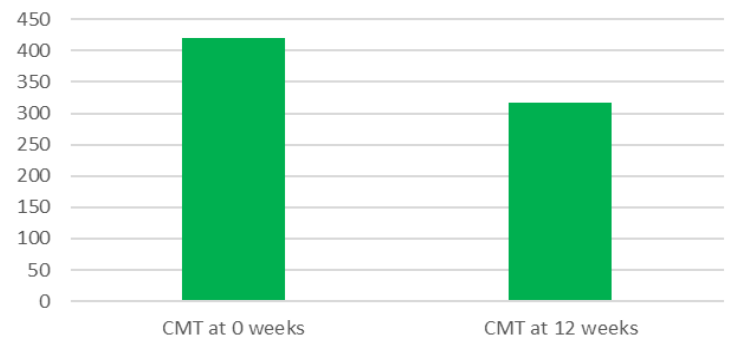


Figure 4 Changes in CMT in Group B at 0 and 12 Weeks

DISCUSSION

The use of Eplerenone, a selective mineralocorticoid receptor antagonist, has been extensively studied in the management of central serous chorioretinopathy (CSCR) owing to its mechanistic role in modifying the pathophysiological alterations within the retinal pigment

epithelium (RPE) and choroid when the renin–angiotensin–aldosterone system is activated (12). Its selective action on mineralocorticoid receptors, sparing androgen receptors, underpins its favorable side effect profile compared to earlier agents (13). Several theories have been proposed to explain CSCR pathogenesis, including focal choroidal hyperpermeability and functional RPE pump failure, both of which support the rationale for mineralocorticoid antagonist therapy (14). The findings of the present study align with previous reports demonstrating that Eplerenone contributes to a reduction in central macular thickness (CMT) without significant improvement in best-corrected visual acuity (BCVA) (15,16). Patients treated with Eplerenone exhibited a greater decrease in CMT over the 12-week follow-up compared to the observation group, reflecting a potential therapeutic benefit at the anatomical level. However, improvements in BCVA were not statistically significant between groups, echoing the observations reported in large randomized trials where Eplerenone did not significantly alter visual outcomes compared to placebo (16). This suggests that anatomical resolution of subretinal fluid may not directly correlate with functional visual recovery within a short follow-up period.

Previous studies have shown a spectrum of responses to Eplerenone, with some reporting complete resolution of subretinal fluid and substantial visual improvement, while others noted initial gains that plateaued over time (17,18). These variable outcomes highlight the complex and multifactorial nature of CSCR, where spontaneous resolution and individual biological variability can influence therapeutic results. In the current study, the spontaneous reduction of CMT observed in the control group further underscores the self-limiting nature of many CSCR cases, raising the critical question of whether immediate pharmacologic intervention is warranted for all patients. The safety profile of Eplerenone in this study was favorable, with no reported adverse effects such as hypertension, cramps, nausea, or migraine, outcomes that have been variably documented in earlier literature (19,20). This observation reinforces the potential tolerability of low-dose Eplerenone (25 mg OD) when patients are properly screened for contraindications like hyperkalemia and renal insufficiency (21).

Among the strengths of this study are its prospective design, the use of a control group, and an adequate sample size for preliminary comparisons. These methodological features enhance the internal validity of the findings. Nonetheless, several limitations must be acknowledged. The relatively short follow-up period restricted the ability to assess long-term outcomes, such as recurrence rates or sustained visual improvements. Additionally, the absence of choroidal thickness measurements limited a more comprehensive anatomical assessment of Eplerenone's effects. A critical limitation was the lack of stratification between acute and chronic CSCR cases, despite evidence suggesting differing responses to treatment based on disease chronicity. The failure to record prior treatments received by patients could have introduced unknown confounding variables. Future research should focus on large, multicenter, randomized controlled trials with longer follow-up durations to more clearly delineate the role of Eplerenone in CSCR management. Incorporating choroidal imaging, stratification based on disease chronicity, and meticulous documentation of prior interventions would allow for a more nuanced understanding of patient responses. Furthermore, the potential for spontaneous resolution should be carefully weighed against pharmacologic intervention, and predictive factors for treatment responsiveness need to be established to personalize management strategies. Overall, the present study contributes to the evolving body of evidence suggesting that Eplerenone may facilitate anatomical improvements in CSCR, albeit without a guaranteed corresponding functional gain. The therapeutic approach to CSCR remains a subject of ongoing debate, balancing the potential benefits of intervention against the natural course of spontaneous recovery in many cases.

CONCLUSION

Eplerenone demonstrated promising effectiveness in the management of central serous chorioretinopathy by contributing to the improvement of visual symptoms, reduction of subretinal fluid, and significant decrease in central macular thickness. The treatment group exhibited a more rapid and pronounced reduction in anatomical changes compared to observation alone, suggesting a potential therapeutic advantage in cases where early intervention is warranted. While visual acuity gains were modest, the overall anatomical improvements highlight Eplerenone's role as a valuable option in the clinical approach to CSCR. These findings support the consideration of Eplerenone as part of early management strategies to promote faster resolution and potentially better long-term outcomes.

AUTHOR CONTRIBUTION

Author	Contribution
Iqra Sajjad*	Substantial Contribution to study design, analysis, acquisition of Data Manuscript Writing Has given Final Approval of the version to be published
Muhammad Ahsan Mukhtar	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
Zulfiqar Uddin Syed	Substantial Contribution to acquisition and interpretation of Data Has given Final Approval of the version to be published
Azka Sohail	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Neha Nadeem	Contributed to Data Collection and Analysis Has given Final Approval of the version to be published
Taimoor Ashraf Khan	Substantial Contribution to study design and Data Analysis Has given Final Approval of the version to be published

REFERENCES

1. Naharwal A, Samanta R, Jayaraj S, Agrawal A. Bullous central serous chorioretinopathy with retinal pigment epithelial macro rip treated with eplerenone monotherapy. *BMJ Case Rep.* 2024;17(8).
2. Feenstra HMA, van Dijk EHC, van Rijssen TJ, Tsonaka R, Diederens RMH, Schlingemann RO, et al. Crossover to Half-Dose Photodynamic Therapy or Eplerenone in Chronic Central Serous Chorioretinopathy Patients. *Ophthalmol Retina.* 2022;6(10):930-8.
3. Xia Y, Hua R. Current perspectives on the use of eplerenone for chronic central serous chorioretinopathy. *Eye (Lond).* 2021;35(12):3445-7.
4. Duan J, Zhang Y, Zhang M. Efficacy and safety of the mineralocorticoid receptor antagonist treatment for central serous chorioretinopathy: a systematic review and meta-analysis. *Eye (Lond).* 2021;35(4):1102-10.
5. Zhang B, Chou Y, Zhao X, Yang J, Chen Y. Efficacy of mineralocorticoid receptor antagonist for central serous chorioretinopathy: a meta-analysis. *Int Ophthalmol.* 2020;40(11):2957-67.
6. Stanescu-Segall D, Touhami S, Bodaghi B, LeHoang P. Eplerenone for chronic central serous chorioretinopathy. *Lancet.* 2020;396(10262):1556-7.
7. Lotery A, O'Connell A, Harris RA, Sivaprasad S, Reeves BC. Eplerenone for chronic central serous chorioretinopathy - Authors' reply. *Lancet.* 2020;396(10262):1557-8.
8. Yusuf IH, Henein C, Sivaprasad S. Infographic: Eplerenone for chronic central serous chorioretinopathy in patients with active, previously untreated disease for more than 4 months: the VICI study. *Eye (Lond).* 2024;38(Suppl 2):33-4.
9. Temkar S, Rajasekar G, Nair S, Deb AK. Intravitreal steroid-associated central serous chorioretinopathy. *BMJ Case Rep.* 2025;18(1).
10. Sadda SR. Lack of efficacy of eplerenone for treatment of active central serous chorioretinopathy. *Eye (Lond).* 2020;34(9):1489-90.
11. Sanhueza A, González R. Mineralocorticoid receptor antagonists in chronic central serous chorioretinopathy. *Medwave.* 2020;20(8):e8036.

12. Uzun S, Uzun F, Ercal O. OCT-A in chronic central serous chorioretinopathy treated with oral eplerenone and half-fluence photodynamic therapy: A comparative study. *Eur J Ophthalmol.* 2024;34(3):Np131.
13. Singh SR, Goté JT, Chhablani J. Randomized controlled trials in central serous chorioretinopathy: A review. *Eye (Lond).* 2023;37(16):3306-12.
14. Clemente L, Cennamo G, Montorio D, Fossataro F, Passaro ML, Costagliola C. Reply to comment on: Optical coherence tomography angiography in central serous chorioretinopathy treated with oral eplerenone and half-fluence photodynamic therapy: A comparative study. *Eur J Ophthalmol.* 2024;34(3):Np132-np3.
15. Lotery A, Sivaprasad S, O'Connell A, Reeves B. Reply to: 'Current perspectives on the use of eplerenone for chronic central serous chorioretinopathy'. *Eye (Lond).* 2021;35(12):3448.
16. Iqbal F, Iqbal K, Inayat B, Arjumand S, Ghafoor Z, Sattar W, Abbas K. Eplerenone Treatment in Chronic Central Serous Chorioretinopathy. *Cureus.* 2021 Oct 1;13(10):e18415.
17. Daugirdas SP, Bheemidi AR, Singh RP. Should We Stop Treating Patients With Eplerenone for Chronic CSCR? Commentary on the VICI Trial. *Ophthalmic Surg Lasers Imaging Retina.* 2021 Jun;52(6):308-310.
18. Abdelhakeem E, El-Nabarawi M, Shamma R. Eplerenone repurposing in management of chorioretinopathy: Mechanism, nanomedicine-based delivery applications and future trends. *Br J Clin Pharmacol.* 2022 Jun;88(6):2665-2672.
19. Fusi-Rubiano W, Saedon H, Patel V, Yang YC. Oral medications for central serous chorioretinopathy: a literature review. *Eye (Lond).* 2020 May;34(5):809-824.
20. Iqbal F, Iqbal K, Inayat B, Arjumand S, Ghafoor Z, Sattar W, Abbas K. Eplerenone Treatment in Chronic Central Serous Chorioretinopathy. *Cureus.* 2021 Oct 1;13(10):e18415.
21. Venkatesh R, Pereira A, Jain K, Yadav NK. Minoxidil induced central serous Chorioretinopathy treated with oral Eplerenone - a case report. *BMC Ophthalmol.* 2020 Jun 5;20(1):219.