INTRODUCTION

Central serous chorioretinopathy (CSC) is characterized by localized detachment of the neurosensory retina and retinal pigment epithelium (RPE). Its incidence is estimated at 5.8 per 100,000 people, predominantly men, who are affected at an incidence six times higher than that in women. While the pathogenesis of CSC is still unclear, the development of subretinal fluid (SRF) is generally regarded as a source of disturbance of the RPE in association with increased choroidal vascular hyperpermeability and choroidal thickening. The acute form of CSC shows a good prognosis in general, with spontaneous regression observed in approximately 60%–80% of the patients. However, chronic or recurrent CSC can result in irreversible visual loss and RPE damage; hence, safe and effective treatment is critical.

Several treatments, including systemic acetazolamide, laser photocoagulation, intravitreal anti-vascular endothelial growth factor injection, and photodynamic therapy (PDT), either with full fluence or reduced fluence, have been used to treat persistent CSC. A recent animal study, which reported the role of the mineralocorticoid receptor in vasodilation and leakage of choroidal vessels, prompted the use of oral mineralocorti-
coid receptor antagonists (e.g., spironolactone and eplerenone) to treat CSC, with generally favorable outcomes. However, their long-term effectiveness and safety profile have not been investigated in a large cohort of patients.

The purpose of this study was to investigate treatment outcomes, recurrence rates, and the safety of oral spironolactone (SPRL) in the management of CSC.

MATERIALS AND METHODS

This study was conducted as an interventional, open-label, retrospective study that included patients with CSC who were treated with SPRL in two tertiary referral centers (Severance Hospital and Gangnam Severance Hospital) between December 2015 and November 2018. This retrospective, observational study was approved by the Institutional Review Board of Gangnam Severance Hospital, Yonsei University College of Medicine, Seoul, Republic of Korea (3-2019-0252).

We reviewed the medical records of 103 patients with CSC involving 107 eyes treated with oral SPRL. Patients with CSC in whom SRF involving the fovea was visualized on optical coherence tomography (OCT) were included. Patients with CSC who had choroidal neovascularization, polypoidal choroidal vasculopathy, and other macular involving diseases, such as retinal artery/vein occlusion or myopic degeneration, were excluded. Patients who received PDT, laser treatment, or intravitreal bevacizumab injections within the last 6 months were also excluded.

Oral SPRL (Aldactone; Pfizer, New York, NY, USA) was administered twice daily (50 mg/day) for 3 months or until SRF accumulation was resolved. If SRF resolved earlier than 3 months, the treatment was discontinued. If SRF persisted after 3 consecutive months, the attending physicians analyzed the patient’s response to treatment to determine if the medication should be discontinued. Blood chemistry, including serum potassium and serum creatinine levels, was evaluated at baseline and at each follow-up visit until the discontinuation of the drug to assess drug tolerance. In cases where a follow-up visit occurred at less than 1 month after treatment began, the laboratory test was not conducted.

Patients visited the clinic at baseline, 1 month, and at an interval of 1–3 months thereafter, depending on the treatment outcomes. If a patient showed complete resolution of SRF, the follow-up visit was extended to 6 months or more. Complete ophthalmic examination included best corrected visual acuity (BCVA), slit lamp biomicroscopy, dilated fundus exam, fluorescein and indocyanine green angiography (HRA-2; Heidelberg Retina Angio-graph System; Heidelberg Engineering, Heidelberg, Germany), spectral-domain OCT, and enhanced-depth imaging OCT (SPECTRALIS; Heidelberg Engineering). Central macular thickness (CMT), SRF height, and subfoveal choroidal thickness (SFCT) were measured by spectral-domain OCT. CMT was defined as the mean thickness within the central grid (1 mm zone), as defined by the Early Treatment of Diabetic Retinopathy Study. SRF height was manually measured from the outer surface of the neurosensory retina to the inner surface layer of the RPE in the central fovea. SFCT was manually measured from the inner surface of the sclera to the outer surface of the RPE via enhanced-depth imaging OCT.

We classified the patients into two groups based on symptom duration before initiating treatment: those who had symptoms for less or more than 3 months were classified as acute and chronic groups, respectively. The two groups were compared with respect to the parameters mentioned above. Additionally, patients with complete resolution of SRF were classified into two groups based on recurrence: one group experienced recurrence of SRF and the other did not. We also classified the patients into three groups as complete responders (CR), partial responders (PR), and non-responders (NR). CR was defined as complete resolution of SRF. PR was defined as a more than 30% decrease in SRF height since the previous visit. NR was defined as a less than 30% decrease in SRF height since the previous visit.

Statistical analyses were performed using SPSS 25.0 (IBM Corp., Armonk, NY, USA). The treatment outcomes were evaluated at baseline, at 1, 3, and 6 months, and at the last follow-up. The paired t-test, independent t-test, chi-square test, Fisher’s exact test, Mann-Whitney test, and linear mixed model were used to compare parameters at baseline with parameters after treatment. P values less than 0.05 were considered statistically significant.

RESULTS

In total, 107 eyes in 103 patients who were diagnosed with CSC and received oral SPRL were enrolled in this study. The mean age of the patients was 51.5±9.3 years; 77 (72.0%) were male. Before this study, 4 (3.7%) had taken systemic steroids, 13 (12.1%) had undergone focal laser photocoagulation, and 41 (38.3%) had received intravitreal bevacizumab injection. Fifty-eight (54.2%) eyes had no history of previous treatment. The mean duration of symptoms in the cohort was 17.7±25.4 weeks. Fifty (46.7%) eyes had acute CSC, and 57 (53.3%) had chronic CSC. The mean duration of follow-up was 48.6±40.2 weeks, and the mean duration of SPRL therapy was 15.5±13.4 weeks (Table 1).

CMT and SRF height significantly decreased after SPRL at all evaluation time points (p<0.001 in all, determined using the linear mixed model followed by Tukey’s Honest Significant Difference test). CMT decreased from 395.4±119.8 µm at baseline to 320.9±87.1 µm, 292.5±80.9 µm, 275.3±67.3 µm, and 249.9±50.8 µm at 1, 3, and 6 months after treatment and the last visit, respectively. SRF decreased from 194.1±122.8 µm to 112.4±88.3 µm, 77.3±90.1 µm, 56.8±79.6 µm, and
28.5±55.5 µm at 1, 3, and 6 months and the last visit, respective-
ly. SFCT decreased from 418.1±108.0 µm at baseline to 407.4±
107.9 µm (p=0.028), 383.1±105.2 µm (p<0.001), 353.5±100.2 µm
(p=0.001), and 366.3±99.7 µm (p=0.002) at 1, 3, and 6 months
and the last visit, respectively. There was a tendency for visual
improvement after treatment, although this was not statisti-
cally significant at any timepoint. Complete resolution of SRF
was achieved in 13.1%, 33.7%, 52.5%, and 81.2% of the patients at 1,
3, and 6 months and the last visit, respectively.

Fourteen (13.1%) eyes showed recurrence during the mean
follow-up of 95.2±34.7 weeks. The mean interval between com-
plete resolution of SRF to recurrence was 18.3±16.8 weeks. Old
age (p=0.001), history of intravitreal bevacizumab injections

Table 1. Demographic and Clinical Characteristics of the Study Population

| Characteristics          | Values |
|-------------------------|--------|
| Age, yr                 | 51.5±9.3 |
| Sex, males              | 77 (72.0) |
| Systemic conditions     |        |
| HTN                     | 13 (12.6) |
| DM                      | 7 (6.8) |
| Previous use of steroids| 4 (3.7)  |
| Previous treatments     |        |
| Laser photocoagulation  | 13 (12.1) |
| Intravitreal Bevacizumab| 41 (38.3) |
| None                    | 58 (54.2) |
| Duration of symptoms, weeks | 17.7±25.4 |
| Eyes with acute CSC (<12 weeks), eyes | 50 (46.7) |
| Eyes with chronic CSC (≥12 weeks), eyes | 57 (53.3) |
| Duration of follow up, weeks | 48.6±40.2 |
| Duration of SPRL therapy, weeks | 15.5±13.4 |
| HTN, Hypertension; DM, diabetic mellitus; CSC, central serous chorioretinopa-
thy; SPRL, spironolactone. Data are presented as mean±standard deviation or n (%). |

Table 2. Comparison of Baseline Characteristics in Non-Recurred and Recurred Eyes

| Characteristics          | Non-recurred (n=93) | Recurred (n=14) | p value |
|-------------------------|---------------------|-----------------|---------|
| Age, yr                 | 50.5±9.2            | 58.6±6.6        | 0.001*  |
| Sex, male               | 70 (75.3)           | 7 (50)          | 0.180†  |
| Duration of symptom, weeks | 15.7±21.8          | 33.4±43.2       | 0.233*  |
| Previous use of steroids| 4 (4.3)             | 0 (0)           | 1.000†  |
| Previous treatments     |                     |                 |         |
| Laser                   | 12 (12.9)           | 1 (7.1)         | 1.000†  |
| Intravitreal anti-VEGF  | 31 (33.3)           | 10 (71.4)       | 0.006†  |
| Duration of medication, weeks | 13.8±9.7       | 26.8±25.2       | 0.079*  |
| Baseline CMT, µm        | 405.5±123.93        | 335.5±59.7      | 0.081*  |
| Baseline SRF, µm        | 204.52±127.21       | 132.07±56.21    | 0.055*  |
| Baseline SFCT, µm       | 425.29±101.66       | 367.29±134.71   | 0.060*  |
| Baseline BCVA, logMAR   | 0.18±0.22           | 0.27±0.22       | 0.048*  |

VEGF; vascular endothelial growth factor; CMT, central macular thickness; SRF, subretinal fluid; SFCT, subfoveal choroidal thickness; BCVA, best-corrected visual
acuity; logMAR, logarithm of the minimum angle of resolution.

Data are presented as mean±standard deviation or n (%).

*Independent t-test; †Fisher’s exact test; ‡chi-square test.

We analyzed the therapeutic effects of SPRL in the recurrence
and non-recurrence groups. In the non-recurrence group, CMT
and SRF showed significant improvement after SPRL treatment
at all timepoints (p<0.001 at all timepoints). SFCT showed a sig-
ificant change at 3 and 6 months and at the last visit (p=0.003,
0.005, and 0.006, respectively). BCVA showed significant im-
provement at 1 (p=0.017) and 6 months (p=0.048) after SPRL.
In the recurrence group, CMT (p=0.001, 0.009, 0.009, and 0.002,
respectively) and SRF height (p<0.001, p=0.004, 0.010, and 0.002,
respectively) showed significant improvement at all
timepoints, similar to those in the non-recurrence group. How-
ever, unlike those in the non-recurrence group, both BCVA and
SFCT showed no significant change after SPRL at all timepoints
in the recurrence group.

Therapeutic outcomes of oral SPRL therapy were analyzed
in the acute and chronic groups. The patients with acute CSC
were younger (p=0.001) and showed greater CMT (p=0.001),
SRF height (p<0.001), and SFCT (p=0.002) at presentation. In
both the acute and chronic CSC groups, CMT and SRF height
decreased significantly at all the evaluation timepoints (p<0.001
each, determined using the linear mixed model followed by
Tukey’s Honest Significant Difference test), following oral
SPRL. A statistically significant decrease in SFCT was observed
at 3 months (p=0.049) in the acute CSC group, while it was ob-
erved at 1, 3, and 6 months in the chronic CSC group (p=0.016,
p=0.001, and p=0.001, respectively). Visual acuity significantly
improved at 1 month in the chronic CSC group (p=0.016), but
not at other evaluation periods in both the acute and chronic
CSC groups. Changes over time between acute and chronic
CSC were not significantly different in regards to CMT, SRF,
and BCVA. However, there was significant difference between
the two groups in SFCT (p<0.001) (Fig. 1). The percentage of

(p=0.006), and poor initial visual acuity (p=0.048) were factors
associated with recurrence (Table 2).
eyes with complete SRF resolution gradually increased in both
the acute and chronic CSC groups (Fig. 2).

There was a tendency for more eyes to achieve complete SRF
resolution at 1 month in the chronic CSC group than in the
acute CSC group (21.1% vs. 6.0%); however, the difference was
not statistically significant ($p=0.074$). SRF resolution, for either

![Graph A: Comparison of CMT changes in acute and chronic CSC groups](image1.png)

![Graph B: Comparison of SRF changes in acute and chronic CSC groups](image2.png)

![Graph C: Comparison of SFCT changes in acute and chronic CSC groups](image3.png)

![Graph D: Comparison of BCVA changes in acute and chronic CSC groups](image4.png)

**Fig. 1.** Comparison of and changes in therapeutic outcomes in patients with acute and chronic central serous chorioretinopathy (CSC) after oral spironolactone. Graphs showing changes in (A) CMT, (B) SRF, (C) SFCT, and (D) BCVA. *$p<0.05$ at baseline between the two groups; **$p<0.001$ acute vs chronic
determined with linear mixed model followed by Tukey's Honest Significant Difference test; †$p<0.05$ change from baseline in the chronic CSC group; ‡$p<0.05$ change from baseline in the acute CSC group. CMT, central macular thickness; SRF, subretinal fluids; SFCT, subfoveal choroidal thickness; BCVA, best-corrected visual acuity; M, months.

![Bar graph A: Proportion of eyes in acute CSC group](image5.png)

![Bar graph B: Proportion of eyes in chronic CSC group](image6.png)

**Fig. 2.** Proportion of patients during follow-up in terms of subretinal fluid resolution. Bar graphs showing the proportion of (A) the total study cohort, (B) acute CSC group, and (C) chronic CSC group. CSC, central serous chorioretinopathy; NR, non-responder; PR, partial responder; CR, complete responder; M, months.
including partial or complete resolution, at 1 month was not associated with SRF resolution at the last follow-up. SRF resolution (including partial or complete resolution) at 3 months was associated with CR (p=0.028) and PR or CR (p<0.001) at the last follow-up.

Two of the 77 (2.6%) male patients developed gynecomastia at 2 and 3 months after treatment. After discontinuation of the drugs, their symptoms resolved. One (0.9%) patient experienced mild elevation of serum creatinine 6 months after taking SPRL, which returned to normal after discontinuation of the medication. One (0.9%) patient reported alopecia at 1 month after treatment and discontinued the medication.

DISCUSSION

The results of this study showed that oral SPRL is associated with SRF resolution and a decrease in choroidal thickness in both acute and chronic CSC. Oral mineralocorticoid receptor antagonists, such as spironolactone and eplerenone, have been proposed for the treatment of CSC based on an animal study, which showed that mineralocorticoid receptor activation is associated with the pathogenesis of CSC. 21 Subsequently, many studies have reported the therapeutic benefit of oral mineralocorticoid receptor antagonists in CSC. Bouquet, et al. 16 reported that SPRL was effective in reducing SRF and SFCT in patients with CSC, with persistent SRF for at least 3 months, compared with placebo, and later found that oral mineralocorticoid receptor antagonists were more effective in eyes with a thicker baseline choroid.17 Daruich, et al. 25 reported similar improvements in CMT and SRF at 1, 3, and 6 months in patients with persistent CSC, defined as non-resolving SRF for at least 4 months, after oral SPRL and eplerenone. Other prospective, placebo-controlled studies also reported significant improvements in SRF and CMT after SPRL and eplerenone treatment. 10,24 However, a recent prospective study found no difference between oral eplerenone and placebo in the treatment outcomes in CSC, 25 hence, further studies are warranted to confirm the treatment efficacy of mineralocorticoid receptor antagonists in the management of CSC, including a comparison study between SPRL and eplerenone.

Complete resolution of SRF was observed in 14.0%, 37.2%, 52.5%, and 72.5% of the patients in our study at 1, 3, and 6 months and the last visit, respectively. Our findings are in line with those of previous studies that reported complete resolution in approximately 38% of the patients with CSC at 3 months and 40%-50% at 6 months after oral mineralocorticoid receptor antagonists. 17,22-24 These rates are relatively lower than those in previous studies, which reported a complete resolution rate of 80% after half-fluence or half-dose of PDT, 26,27 although short-term results might be comparable between oral SPRL and half-dose PDT. 28 Moreover, oral mineralocorticoid receptor antagonists appear to show the greatest efficacy among past oral medications that have been tried in CSC, including beta blockers, Helicobacter pylori agents, omeprazole, rifampicin, methotrexate, aspirin, acetazolamide, mifepristone, melatonin, finasteride, ketoconazole, antioxidants, and curcumin phospholipid. 29 Meanwhile, we observed recurrence in 13% of the eyes after achieving complete resolution within a mean period of 18.3±16.8 weeks. Herold, et al. 30 reported a higher recurrence rate of 48%, including eyes with non-resolving SRF after SPRL. In general, these recurrence rates might be higher than those after PDT, which range from 9% to 21%. 13,30,31 Factors associated with recurrence included older age, history of previous bevacizumab injections, and poorer initial visual acuity in this study. Older age could be associated with frequent recurrence because the repair capacity of RPE may decrease with aging. 4 A history of previous intravitreal bevacizumab and poorer initial visual acuity may indicate more chronic and recalcitrant disease that is more likely to recur. The presence of occult choroidal neovascularization has been reported in CSC, which can be detected on OCT angiography. OCT angiographic findings were not included in this study; hence, it is possible that eyes with CSC that harbored occult choroidal neovascularization could have been included. Also, eyes that were treated with and responded to bevacizumab could potentially have occult choroidal neovascularization, which could have led to the recurrence of SRF after oral SPRL treatment.

Despite anatomical improvement, significant visual improvement was not observed at all visits, except at 1 month after treatment in the chronic CSC group. Other studies reported visual improvements after oral SPRL or eplerenone treatment. 17,22-24 This might be due to a combined population in this study with both chronic and non-chronic CSC, while other studies included patients with non-chronic or non-resolving CSC alone. We analyzed patients with acute and chronic CSC separately, because acute CSC could spontaneously resolve within approximately 3 months. It might be argued that the 72.5% CR rate of acute CSC at the final visit in our study might not be solely due to the therapeutic effect of SPRL, because acute CSC reportedly spontaneously resolves in more than half of patients. 4,5 Many of the eyes with acute CSC in our study would have likely spontaneously recovered without treatment. However, it is unknown whether oral SPRL might have contributed to faster SRF resolution. The CR rate at the last visit was 66.7% in patients with chronic CSC. Considering that these eyes had persistent SRF for more than 3 months, spontaneous resolution of SRF is less likely; nevertheless, a relatively high proportion of patients achieved CR after oral SPRL. Interestingly, the proportion of CRs at 1 month after oral SPRL was higher in the chronic CSC patients, who also showed greater visual improvement, compared to the acute CSC patients. Whether oral mineralocorticoid receptor antagonists are particularly more effective in patients with chronic CSC needs to be validated in further studies.

Adverse events in this study included gynecomastia in two male patients and transient elevation of serum creatinine in
one. All adverse events resolved, however, after discontinuation of the drug without treatment. One male patient reported increasing hair loss after 1 month of SPRL use and discontinued the medication. It is not clear whether acute alopecia was associated with SPRL, since SPRL is known to slow androgen production; hence, it is sometimes used to treat androgenic alopecia.23,24 Stress might have contributed to the development of CSC in that patient and may be a more plausible cause of alopecia. Other reported adverse events, including fatigue, dizziness, gastric discomfort, and hyperkalemia,25,26 were not observed in our study.

Because of the retrospective study design, not all patients were followed-up on a regular basis until the last follow-up period. Because patients with previous PDT, laser treatment, or intravitreal bevacizumab within 6 months, who are likely to be chronic or recurrent patients, were excluded from the study, potential selection bias should be considered in taking our recurrence rate. Additionally, there was no control group. Despite these limitations, however, we reported real-life clinical data of a relatively large number of patients with acute and chronic CSC treated with oral SPRL.

Our study results indicate that oral SPRL results in anatomical improvements in both acute and chronic CSC with excellent safety profiles. Although PDT might be superior in terms of SRF resolution and recurrence, its high cost and invasiveness may make oral SPRL a better first-line treatment option, especially in eyes with persistent SRF.

ACKNOWLEDGEMENTS

This research was supported by the Basic Science Research Program through the National Research Foundation of Korea (NRF) under 2019R1A2C2002393 (C.S.L.).

AUTHOR CONTRIBUTIONS

Conceptualization: Jae Yong Han and Christopher Seungkyu Lee. Data curation: Yong Joon Kim and Eun Young Choi. Formal analysis: Jae Yong Han. Funding acquisition: Christopher Seungkyu Lee. Investigation: Jae Yong Han, Yong Joon Kim, Junwon Lee, and Ji Hwan Lee. Methodology: Jae Yong Han and Eun Young Choi. Project administration: Suk Ho Byeon and Sung Soo Kim. Resources: Ji Hwan Lee, Min Kim, and Suk Ho Byeon. Software: Junwon Lee. Supervision: Sung Soo Kim. Validation: Min Kim. Visualization: Jae Yong Han. Writing—original draft: Jae Yong Han. Writing—review & editing: Jae Yong Han and Christopher Seungkyu Lee. Approval of final manuscript: all authors.

ORCID iDs

Jae Yong Han https://orcid.org/0000-0001-9346-3220
Yong Joon Kim https://orcid.org/0000-0001-6090-2549
Eun Young Choi https://orcid.org/0000-0002-1668-6452
Junwon Lee https://orcid.org/0000-0003-0543-7132
Ji Hwan Lee https://orcid.org/0000-0003-1759-8195

Min Kim https://orcid.org/0000-0003-1873-6959
Suk Ho Byeon https://orcid.org/0000-0003-0913-8623
Sung Soo Kim https://orcid.org/0000-0002-0574-7993
Christopher Seungkyu Lee https://orcid.org/0000-0001-5054-9470

REFERENCES

1. Kitzmann AS, Pulido JS, Diehl NN, Hodge DO, Burke JP. The incidence of central serous chorioretinopathy in Olmsted County, Minnesota, 1980-2002. Ophthalmology 2008;115:169-73.
2. Imamura Y, Fujiwara T, Margolis R, Spaide RF. Enhanced depth imaging optical coherence tomography of the choroid in central serous chorioretinopathy. Retina 2009;29:1469-73.
3. Spaide RF; Hall L, Haas A, Campesas L, Yannuzzi LA, Fisher YL, et al. Indocyanine green videoangiography of older patients with central serous chorioretinopathy. Retina 1996;16:203-13.
4. Daruič A, Mates A, Marchionno L, De Azevedo JD, Ambresin A, Mantel I, et al. Acute central serous chorioretinopathy: factors influencing episode duration. Retina 2017;37:1905-15.
5. Gilbert CM, Owens SL, Smith PD, Fine SL. Long-term follow-up of central serous chorioretinopathy. Br J Ophthalmol 1984;68:815-20.
6. Nicholson B, Noble J, Foroozhan F, Meyerle C. Central serous chorioretinopathy: update on pathophysiology and treatment. Surv Ophthalmol 2013;58:103-26.
7. Yannuzzi LA. Type A behavior and central serous chorioretinopathy. Trans Am Ophthalmol Soc 1986;84:799-845.
8. Pikkel J, Beiran I, Ophir A, Miller B. Acetazolamide for central serous retinopathy. Ophthalmology 2002;109:1723-35.
9. Burumcek E, Mudun A, Karacorlu S, Arslan MO. Laser photocoagulation for persistent central serous retinopathy: results of long-term follow-up. Ophthalmology 1997;104:616-22.
10. Beger I, Koss MJ, Koch F. [Treatment of central serous chorioretinopathy: MicroPulse photocoagulation or bevacizumab]. Ophthalmologie 2012;109:1224-32.
11. Kim GA, Rim TH, Lee SC, Byeon SH, Koh HJ, Kim SS, et al. Clinical characteristics of responders to intravitreal bevacizumab in central serous chorioretinopathy patients. Eye (Lond) 2015;29:732-40.
12. Roisman L, Maghalhães LF, Lavinsky D, Moraes N, Hirai FE, Cardillo JA, et al. Micropulse diode laser treatment for chronic central serous choriotiretinopathy: a randomized pilot trial. Ophthalmic Surg Lasers Imaging Retina 2013;44:465-70.
13. Chan WM, Lai TY, Lai RY, Tang EW, Liu DT, Lam DS. Safety enhanced photodynamic therapy for chronic central serous chorioretinopathy: one-year results of a prospective study. Retina 2008;28:85-93.
14. Nicoló M, Eandi CM, Alovis C, Grignolo FM, Traverso CE, Musetti D, et al. Half-fluence versus half-dose photodynamic therapy in chronic central serous chorioretinopathy: Am J Ophthalmol 2014;157:1033-7.
15. Park W, Kim M, Kim YH, Park YH. Comparing effects of photodynamic therapy in central serous chorioretinopathy: full-dose versus half-dose therapy. Graefes Arch Clin Exp Ophthalmol 2019;257:2155-61.
16. Bousquet E, Beydoun T, Rothschild PR, Bergin C, Zhao M, Batista R, et al. Spironolactone for nonresolving central serous chorioretinopathy: a randomized controlled crossover study. Retina 2015;35:2505-15.
17. Bousquet E, Dhundass M, Lejoyeux R, Shinojima A, Krivosic V, Mrejen S, et al. Predictive factors of response to mineralocorticoid receptor antagonists in nonresolving central serous chorioretinopathy. Am J Ophthalmol 2019;188:80-7.
18. Cakir B, Fischer F, Ehlken C, Bühler A, Stahl A, Schlunck G, et al.
Clinical experience with eplerenone to treat chronic central serous chorioretinopathy. Graefes Arch Clin Exp Ophthalmol 2016;254:2151-7.

19. Ghadiali Q, Jung JJ, Yu S, Patel SN, Yannuzzi LA. Central serous chorioretinopathy treated with mineralocorticoid antagonists: a one-year pilot study. Retina 2016;36:611-8.

20. Lee JH, Lee SC, Kim H, Lee CS. Comparison of short-term efficacy between oral spironolactone treatment and photodynamic therapy for the treatment of nonresolving central serous chorioretinopathy. Retina 2019;39:127-33.

21. Zhao M, Célérier I, Bousquet E, Jeanny JC, Jonet L, Savoldelli M, et al. Mineralocorticoid receptor is involved in rat and human ocular chorioretinopathy. J Clin Invest 2012;122:2672-9.

22. Daruich A, Maet A, Dirani A, Gallice M, Nicholson L, Sivaprasad S, et al. Oral mineralocorticoid-receptor antagonists: real-life experience in clinical subtypes of nonresolving central serous chorioretinopathy with chronic epitheliopathy. Transl Vis Sci Technol 2016;5:2.

23. Rahimy E, Pitcher JD 3rd, Hsu J, Adam MK, Shahlaee A, Samara WA, et al. A randomized double-blind placebo-control pilot study of eplerenone for the treatment of central serous chorioretinopathy (ecselior). Retina 2018;38:962-9.

24. Sun X, Shuai Y, Fang W, Li J, Ge W, Yuan S, et al. Spironolactone versus observation in the treatment of acute central serous chorioretinopathy. Br J Ophthalmol 2018;102:1060-5.

25. Lotery A, Sivaprasad S, O’Connell A, Harris RA, Culliford L, Ellis L, et al. Eplerenone for chronic central serous chorioretinopathy in patients with active, previously untreated disease for more than 4 months (VICI): a randomised, double-blind, placebo-controlled trial. Lancet 2020;395:294-303.

26. Fujita K, Imamura Y, Shinoda K, Matsumoto CS, Mizutani Y, Hashizume K, et al. One-year outcomes with half-dose verteporfin photodynamic therapy for chronic central serous chorioretinopathy. Ophthalmology 2015;122:555-61.

27. Inoue R, Sawa M, Tsujikawa M, Gomi F. Association between the efficacy of photodynamic therapy and indocyanine green angiography findings for central serous chorioretinopathy. Am J Ophthalmol 2010;149:441-6.e1-2.

28. Fusi-Rubiano W, Saeedon H, Patel V, Yang YC. Oral medications for central serous chorioretinopathy: a literature review. Eye (Lond) 2020;34:809-24.

29. Herold TR, Rist K, Priglinger SG, Ulbig MW, Wolf A. Long-term results and recurrence rates after spironolactone treatment in nonresolving central serous chorio-retinopathy (CSCR). Graefes Arch Clin Exp Ophthalmol 2017;255:221-9.

30. Cardillo Piccolino F, Eandi CM, Ventre L, Rigault de la Longrais RC, Grignolo FM. Photodynamic therapy for chronic central serous chorioretinopathy. Retina 2003;23:752-63.

31. Yannuzzi LA, Slakter JS, Gross NE, Spaide RE, Costa DL, Huang SI, et al. Indocyanine green angiography-guided photodynamic therapy for treatment of chronic central serous chorioretinopathy: a pilot study. Retina 2003;23:288-98.

32. Levy LL, Emer JJ. Female pattern alopecia: current perspectives. Int J Womens Health 2013;5:541-56.