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Play, pressure, and pachychoroid: A case series on e-sports players

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Abstract

Purpose: The pachychoroid disease spectrum is characterized by choroidal thickening, vascular hyperpermeability, and structural alterations in the choroidal circulation. This can lead to central serous chorioretinopathy (CSC), which is clinically seen as retinal pigment epithelium detachments and subretinal fluid accumulation. Despite the fact that corticosteroid exposure is a main risk factor for CSC, its pathogenesis is unknown. This paper describes a case series in which individuals engaged in competitive video gaming presented with pachychoroid disease, and sheds light on the impact of prolonged screen exposure and e-sports-related stress on pachychoroid disease.

Case presentation: We report 8 male e-sports players diagnosed with pachychoroid disease, including 6 with CSC and 2 with uncomplicated pachychoroid. All reported average daily screen exposure of 5–10 h and heightened stress during tournaments. Some cases resolved with lifestyle changes, while others required medical intervention. Reduction in video gaming and stress was correlated with symptomatic improvement.

Conclusions: High-intensity e-sports may contribute to pachychoroid disease through prolonged screen exposure and sustained stress. Live streaming and competitive pressure may amplify these effects. Stress management and regulated screen time could mitigate risks. This case series highlights a possible association between prolonged gaming stress and pachychoroid disease. Awareness and the implementation of preventive measures are essential for maintaining ocular health in e-sports players. Further research with larger cohorts is needed.

Keywords

Central serous chorioretinopathy, digital eye health, e-sports, gaming, pachychoroid, screen exposure, stress

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Introduction

The pachychoroid disease spectrum serves as an umbrella term encompassing a group of chorioretinal disorders characterized by choroidal vascular alterations, resulting in outer retinal and choriocapillaris impairment. These conditions include uncomplicated pachychoroid, pachychoroid pigment epitheliopathy, pachychoroid neovascularopathy, aneurysmal type 1 neovascularization (polypoidal choroidal vasculopathy), peripapillary pachychoroid syndrome and central serous chorioretinopathy (CSC).^{1,2} These disorders share a common pathophysiological mechanism, which manifests progressively through different stages involving dilated pachyvessels, particularly in Haller's layer, choroidal congestion, and increased hydrostatic pressure, which may contribute to choriocapillaris ischemia, retinal pigment epithelium (RPE) dysfunction,

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choroidal venous insufficiency and altered fluid dynamics within the retina and subretinal space.^{1–6} Emerging evidence suggests that psychological stress may exacerbate these choroidal changes, potentially influencing disease onset and progression.^{1,6} Given the increasing prevalence of stress-related lifestyles, particularly in high-performance activities, understanding the interplay between stress and pachychoroid disease is crucial for developing targeted preventive and therapeutic strategies.^{1,6,7}

CSC is characterized by the accumulation of fluid under the retina, leading to distorted vision and potential permanent vision loss.^{1–4} It predominantly affects the macula. Although CSC can resolve spontaneously, its recurrence and chronic course can lead to significant visual impairment.³ The etiology of CSC remains largely unknown, but correlations have been identified with stress and certain lifestyle factors. The association between elevated corticosteroid levels—both endogenous and exogenous—and CSC has been well-documented.^{8,9} Additionally, individuals with type-A personality traits, high-stress lifestyles, sleep apnea, poor sleep quality, pregnancy, hypertension, smoking, short axial length, hyperopia, *Helicobacter pylori* infection, and male gender are considered to have an increased risk of developing CSC, highlighting the potential contribution of psychosocial and systemic factors to its pathophysiology.^{4,10,11}

E-sports, short for electronic sports, refers to competitive and organized video gaming played at professional or semi-professional levels.¹² It involves structured tournaments, team-based gameplay, live broadcasting, and prize-based competitions, requiring not only strategic and reflexive skills but also sustained visual attention and psychological resilience.¹² Due to its increasing global popularity and digital engagement, e-sports is now recognized as a highly demanding domain with unique occupational health implications.¹² The prolonged use of digital screens for gaming is known to contribute to myopia progression; moreover, it has been proposed to exacerbate the risk of CSC and other pachychoroid diseases, given its association with increased stress and eye strain, and has also become a subject of growing interest.¹³ The rise of professional e-sports, which requires prolonged screen exposure, has introduced a new demographic potentially at risk of CSC. E-sports players operate in high-pressure environments, experiencing both psychological and physiological stressors. Competitions require intense concentration, rapid reflexes, and sustained mental engagement, all of which contribute to elevated endogenous cortisol levels—a key factor associated with the pachychoroid disease. Additionally, the psychological stress of competitive gaming is compounded by the physical strain of extended gameplay sessions without adequate breaks. Poor posture and a lack of regular physical activity further exacerbate physiological stress, potentially triggering pachychoroid changes and increasing CSC susceptibility. Given their heightened vulnerability to stress-related

health issues, e-sports players represent a key population for investigating the link between stress and CSC. Recognizing this association may help inform targeted management strategies, including stress-reduction interventions aimed at mitigating CSC risk in this group.

Hence, we present this case series to emphasize the potential association between the pachychoroid disease—particularly CSC—and e-sports players.

Case presentation

Patient 1

A 29-year-old male *Counter-Strike 2* (CS2) player, previously active in *Counter-Strike: Global Offensive* and *Counter-Strike: Source*, presented with progressively worsening blurred vision and eye strain, particularly following prolonged gaming sessions averaging 6–8 h per day over the past 10 years. His symptoms worsened during events and tournaments, where he experienced significant performance-related stress. Refractive values were +1.25 D in the right eye and –0.75 D in the left eye, indicating a hyperopic shift, and best-corrected visual acuity (BCVA) was 20/40 and 20/20, respectively. Additionally, he disclosed an 8-year history of smoking, with an average consumption of 1 pack per day. Optical coherence tomography (OCT) revealed an accumulation of subretinal fluid (SRF) in the foveal region. Further evaluation was not possible, as the patient declined both fluorescein angiography (FFA) and indocyanine green angiography (ICGA). However, no evidence of obvious type 1 choroidal neovascular membrane was observed in optical coherence tomography angiography (OCTA). No regression of SRF was observed over a 4-month follow-up period without any medication or intervention (Figure 1). No change was observed in the final BCVA. He mentioned that he had not stopped smoking but had reduced his playing time by almost half. ICGA, FFA, and photodynamic therapy (PDT), and micropulse laser were recommended; however, the patient declined. Consequently, treatment was initiated with topical corticosteroids, non-steroidal anti-inflammatory eye drops, and oral eplerenone. The patient remains under regular follow-up and monitoring.

Patient 2

A 31-year-old male *Valorant* player presented with blurred vision in the right eye (20/32) following a prolonged gaming session. Refractive measurements were –1.00 D in the right eye and –0.75 D in the left eye, with best-corrected visual acuity (BCVA) of 20/32 and 20/20, respectively. He was diagnosed with CSC and was advised to avoid screen exposure and adopt a stress-free lifestyle, without the use of medication. He reported a history of daily gaming sessions lasting 5–6 h across the

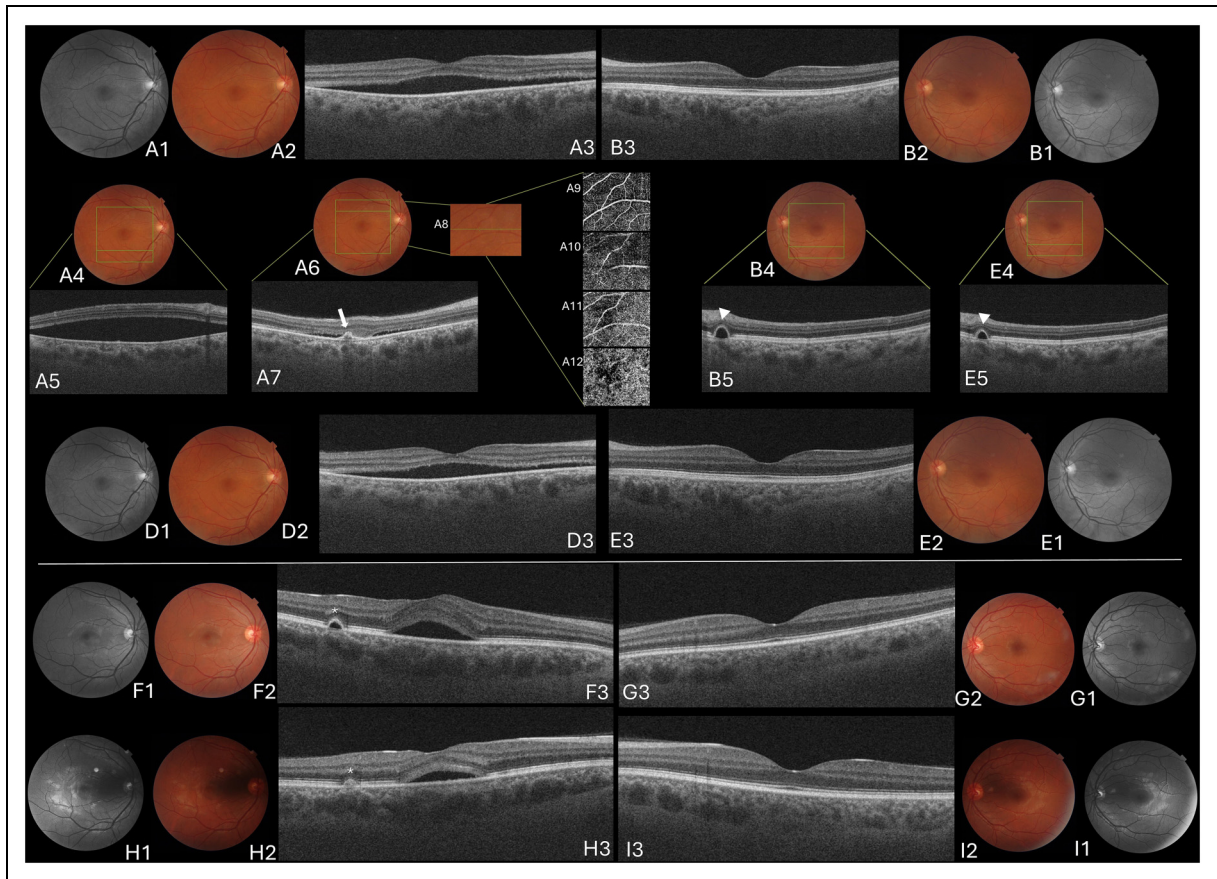


Figure 1. Baseline imaging and follow-up findings of patients 1 and 3 are presented, including red-free images, fundus photographs, and optical coherence tomography (OCT) scans. For Patient 1, baseline imaging (A1, B1, A2, B2, A3, B3) shows initial findings in the right and left eyes. In the right eye, significant subretinal fluid (SRF) is notable on the OCT scan (A3). An inferior OCT section (A5) demonstrates gravity-dependent SRF accumulation, while a superior OCT section (A7) reveals an irregular pigment epithelial detachment (PED, white arrow) resembling a double-layer sign. This finding raises suspicion of a type 1 choroidal neovascular membrane (CNV) associated with pachychoroid neovascularopathy. Enlarged fundus photograph of the suspicious area (A8), followed by optical coherence tomography angiography (OCTA) images of the superficial (A9), deep (A10), outer retina (A11), and choriocapillaris (A12) layers. No evidence of obvious CNV is observed in OCTA. In the left eye, an inferior OCT section (B5) highlights a serous PED (arrowhead). By week 16, the PED height had decreased from 156 μm to 126 μm (E5, arrowhead) in left eye, though no significant reduction in SRF was observed (D3) in right eye. Subfoveal choroidal thickness (CT) measured 439 μm in the right eye and 353 μm in the left eye at baseline, with a slight decrease to 435 μm in the right eye and an increase to 420 μm in the left eye at the final visit. For Patient 3, baseline imaging (F1, G1, F2, G2, F3, G3) reveals a serous PED (F3, asterisk) accompanied by SRF in the right eye. At the 20-week follow-up, the SRF had decreased, and the serous PED had resolved (H3, asterisk). CT measurements were 425 μm and 365 μm in the right and left eyes, respectively, at baseline, with minimal changes to 417 μm and 360 μm at the final visit.

last 4 years. Notably, he denied any history of active smoking or exposure to secondhand smoke. His symptoms improved significantly following the reduction of daily gaming hours and the incorporation of regular visual breaks into his routine. By the end of the third month, complete resolution of SRF was observed, and BCVA improved to 20/20 (Figure 2).

Patient 3

A 29-year-old male CS2 player presented with complaints of blurred vision. He reported playing for up to 8 h daily

during the previous 5.5 years, often in internet cafés, where he was frequently exposed to secondhand smoke. Refractive values were -0.5 D in the right eye and -0.25 D in the left eye, and BCVA was 20/40 and 20/20, respectively. He was diagnosed with CSC. His gaming sessions were typically prolonged without breaks or physical activity. Although partial regression of SRF was noted during follow-up, and BCVA improved to 20/32, complete resolution was not achieved after 20 weeks. The patient acknowledged difficulties in fully adhering to lifestyle modifications, particularly in reducing screen time. The patient declined micropulse laser therapy and

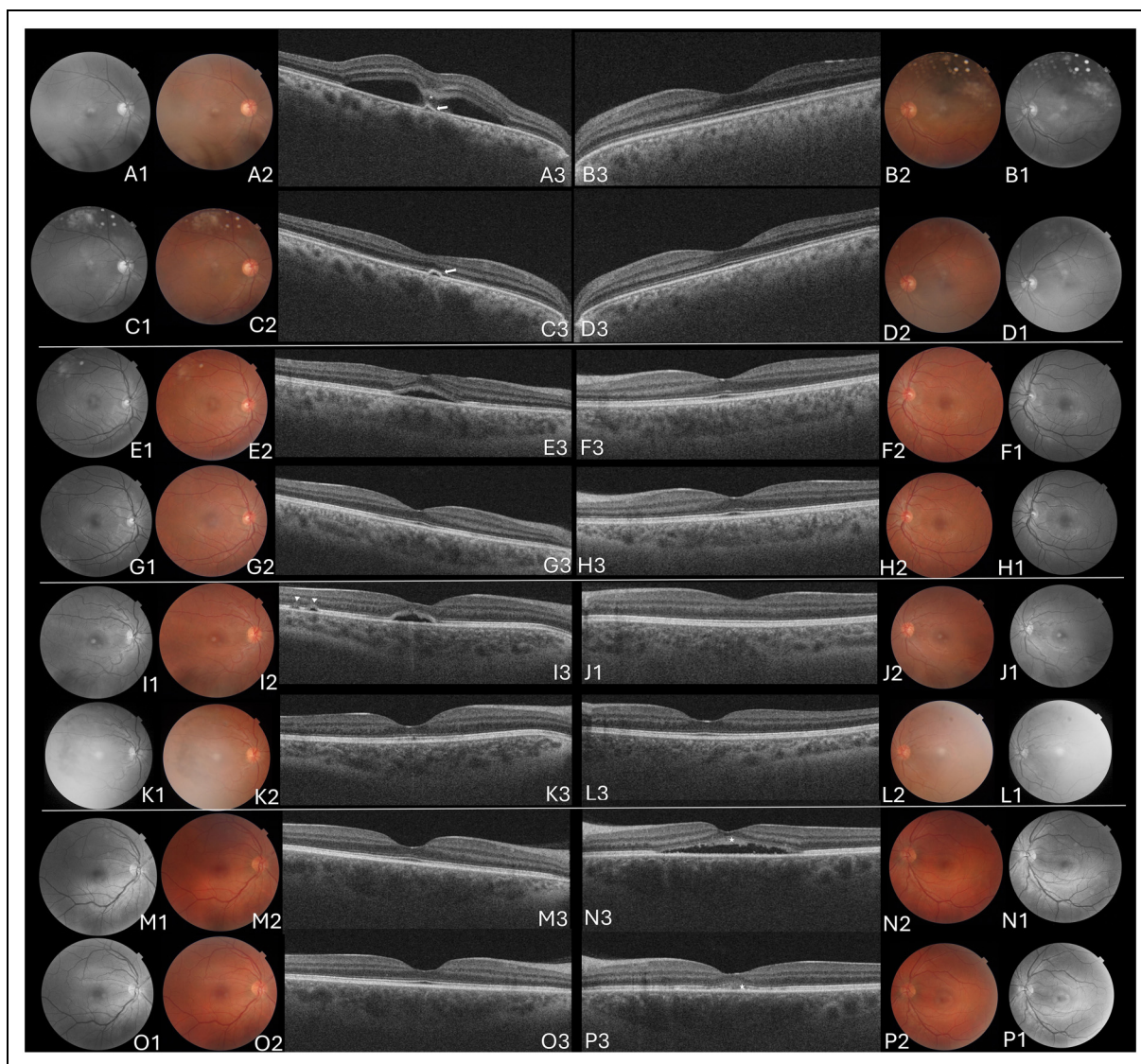


Figure 2. Baseline imaging and follow-up findings of patients 4, 2, 5, and 6 are depicted, including red-free images, fundus photographs, and optical coherence tomography (OCT) scans. For Patient 4, baseline imaging (A1, B1, A2, B2, A3, B3) revealed a pigment epithelial detachment (PED) marked by a *white arrow* and subretinal fluid (SRF) accompanied by a retinal dipping sign or outer retinal sagging (A3, *asterisk*). By week 12, OCT imaging demonstrated complete resolution of SRF, while the PED (C3, *white arrow*) persisted. Subfoveal choroidal thickness (CT) demonstrated a decrease in the right eye from 426 μm to 398 μm , while it remained relatively stable in the left eye, changing from 229 μm to 236 μm . For Patient 2, baseline imaging (E1, F1, E2, F2, E3, F3) revealed diffuse SRF and an accumulation of photoreceptor outer segments (*brush border pattern*) in this SRF (E3). At the 12-week follow-up (G3), the SRF was gone. CT decreased from 381 μm to 358 μm in the right eye and from 345 μm to 339 μm in the left eye. For Patient 5, baseline imaging (I1, J1, I2, J2, I3, J3) identified a brush border pattern, associated SRF, and 2 serous PEDs (*white arrowheads*) on OCT (I3). Significant regression of these findings was observed at the 16-week follow-up (K3). CT decreased from 411 μm to 371 μm in the right eye and from 383 μm to 357 μm in the left eye. For Patient 6, baseline imaging (M1, N1, M2, N2, M3, N3) demonstrated diffuse SRF, a brush border pattern (*white star*), and underlying fibrinoid hyper-reflective deposits in the left eye on OCT (N3). By week 20, SRF had completely resolved, but hyper-reflective subretinal deposits (*white star*) formed a bulge in the subretinal area. CT decreased in the right eye from 534 μm to 392 μm , while it decreased from 622 μm to 518 μm in the left eye.

photodynamic therapy (PDT). Treatment was initiated with topical steroid and non-steroidal eye drops, as well as oral eplerenone. Long-term outcomes have not yet been determined. He remains under active follow-up.

Patient 4

A 33-year-old male *Knight Online* player presented with blurred vision and was diagnosed with CSC in the right eye based on OCT findings. Refractive values were

+1.00 D in the right eye and −0.50 D in the left eye, indicating a hyperopic shift. BCVA was 20/40 and 20/20, respectively. He reported engaging in prolonged gaming sessions, averaging approximately 10 h per day for the past 8 years. He reported experiencing significant stress and anxiety during competitive gameplay, which he believed contributed to the development of his symptoms. In addition, he disclosed a 10-year history of smoking, averaging 1.5 packs per day. Following a 4-month period of both gaming and smoking cessation, his condition showed marked improvement. His BCVA improved to 20/20, and SRF completely resolved, although a minimal residual perifoveal pigment epithelial detachment persisted.

Patient 5

A 29-year-old male *PUBG Mobile* player presented with bilateral eye discomfort and blurred vision in the right eye, and was diagnosed with CSC based on OCT imaging findings. Refractive values were −2.00 D in both eyes. BCVA was 20/32 in the right, 20/20 in the left eye. He reported playing games on his mobile device for approximately 5 to 6 h daily over the past 3.5 years, often under poor lighting conditions. His symptoms improved, BCVA increased to 20/20, and SRF resolved after he began using adequate lighting, incorporated regular visual breaks, and successfully reduced his daily gaming time to a maximum of 1 h—although he was unable to completely cease gaming.

Patient 6

A 31-year-old male *Valorant* player presented with sudden-onset blurred vision in the left eye. Refractive measurements were −2.25 D in the right eye and −2.00 D in the left eye, with best-corrected visual acuity (BCVA) of 20/20 and 20/40, respectively. Comprehensive ophthalmic and OCT examinations confirmed the diagnosis of CSC in the left eye. The patient reported a combined gaming and streaming routine of approximately 5 h per day on his personal computer over the past 5 years. He also reported an active history of actively playing *CS:GO* for 4 to 5 years prior to transitioning to *Valorant*. After 20 weeks of screen time reduction and lifestyle modifications, SRF completely resolved. Despite the presence of minimal sub-retinal fibrin, BCVA improved to 20/20, following lifestyle modifications emphasizing stress reduction and minimal screen exposure, without any pharmacological treatment.

Patient 7

A 35-year-old male who regularly played of *League of Legends* (LoL) and *Defense of the Ancients 2* (Dota 2), presented with complaints of eye strain and was diagnosed

with findings of computer vision syndrome, characterized by conjunctival hyperemia and dry eye. Refractive measurements were near emmetropic values, and best-corrected visual acuity (BCVA) was 20/20 in both eyes, consistent with emmetropia. Subsequent OCT performed for screening purposes incidentally revealed uncomplicated pachychoroid, which was recorded as a secondary diagnosis (Figure 3). The patient reported playing video games on his personal computer for approximately 15 h per week over the past 8 years. He noted that he primarily played competitive matches in a dark environment and also engaged in live broadcasting during his gaming sessions. By week 24, no significant change in choroidal thickness (CT) was observed despite recommendations to adopt a stress-reducing lifestyle and limit screen time. However, the patient subjectively reported improvement in digital eye strain symptoms with the use of artificial tear supplements.

Patient 8

A 34-year-old male *Rocket League* player was diagnosed with uncomplicated pachychoroid during a routine ophthalmological examination for myopia. Refractive measurements were −1.75 D in both eyes, with BCVA of 20/20 bilaterally. He reported playing video games on a personal computer for approximately 2.5 h daily over the past 6 years, often without taking breaks. The patient denied experiencing any significant ocular symptoms, including digital eye strain. He also reported experiencing stress and anxiety during competitive gaming sessions. Despite recommendations to adopt a stress-reducing lifestyle and limit screen exposure, no significant change in CT was observed by week 20.

Common findings for the case series cohort

None of the patients exhibited a *Cushingoid* appearance. All patients were evaluated for endogenous corticosteroid elevation, and results were negative. There was no reported history of exogenous steroid use, bodybuilding, or intensive physical exercise. All patients were Caucasian males. None of the patients had any systemic or ocular comorbidities, including hypertension or *H. pylori* infection. Additionally, none of the patients had a known psychiatric disorder or were receiving treatment for such conditions. Patients 1 and 4 were active smokers. A hyperopic shift was observed exclusively in Patients 1 and 4. No patients had high axial myopia (axial length >26 mm) or high axial hyperopia (<22 mm). A summary of individual choroidal and retinal parameters is presented in Supplementary Table 1.

Patients were included in the study if they fulfilled the following criteria:

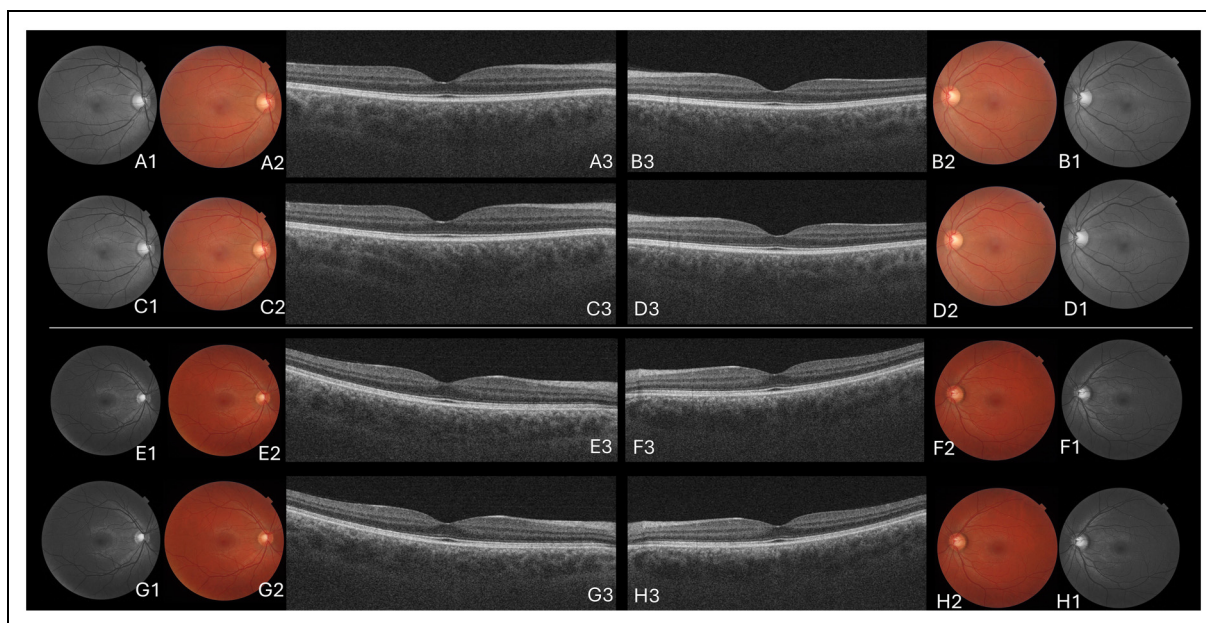


Figure 3. Baseline imaging and follow-up findings of patients 7 (A, B, C, D) and 8 (E, F, G, H) are depicted, including red-free images, fundus photographs, and optical coherence tomography (OCT) scans. Note the presence of pachyvessels in the choroid and thickened Haller's layer. For Patient 7, at the 24-week follow-up (C3, D3) compared to baseline (A3,B3), subfoveal choroidal thickness (CT) increased from 491 μm to 513 μm in the right eye and from 471 μm to 485 μm in the left eye. For Patient 8, at the 20-week follow-up (G3,H3) compared to baseline (E3,F3), CT slightly decreased from 427 μm to 423 μm in the right eye and from 461 μm to 455 μm in the left eye.

1. Subfoveal CT of $\geq 300 \mu\text{m}$,
2. Presence of pachyvessels—dilated large-caliber vessels within Haller's layer—accompanied by attenuation or compression of the inner choroidal layers, including Sattler's layer and the choriocapillaris,
3. RPE alterations, including serous retinal detachment (SRD) and/or RPE detachment, without signs of choroidal neovascularization (CNV),
4. Absence of confounding ocular conditions, including diabetic retinopathy, hypertensive retinopathy, uveitis, or exudative age-related macular degeneration.

Furthermore, all OCT-based measurements and findings were confirmed by 2 experienced retinal specialists (MCS, FG).

None of the patients reported symptoms of macropsia or micropsia; individuals with blurred vision typically described it as a fog-like disturbance. FFA and ICGA were recommended for all patients; however, imaging could not be performed due to patient refusal. Diagnoses were established using a combination of fundus photography, red-free imaging, spectral-domain OCT, and, when applicable, OCTA. In addition, the absence of fundus autofluorescence (FAF) imaging represents a limitation of this case series. All cases were managed at a

single tertiary care center (Bilecik Training and Research Hospital, Türkiye), with interinstitutional collaboration among co-authors for clinical interpretation and discussion. Written informed consent was obtained from all participants for the inclusion of their clinical data and medical history in this case series. Voluntarily reported playtime among e-sports players, provided as a Supplementary File.

Discussion

This case series describes 8 patients with CSC who were also actively involved in e-sports. All participants were free of systemic illnesses, ocular comorbidities, corticosteroid use, and psychiatric diagnoses. All 8 included participants were male and within the known age range for CSC susceptibility, and shared a unique occupational or lifestyle factor: prolonged, high-intensity engagement in competitive gaming.

The pachychoroid disease spectrum, encompassing chorioretinal disorders characterized by choroidal vascular hyperpermeability, dilated pachyvessels, and RPE dysfunction, has been increasingly associated with systemic and environmental stressors. Among these, psychological stress has long been implicated in the pathogenesis of CSC through its influence on cortisol regulation and autonomic nervous system activity. Previous studies have demonstrated that CSC primarily affects males aged 20–

50 years and is strongly associated with psychological stress, elevated endogenous cortisol, and type A personality traits.^{4,8–11} These mechanisms are especially relevant to e-sports players, who are frequently exposed to continuous cognitive load, irregular sleep patterns, and performance-related pressure in a screen-centric environment. Although a formal control group was not included, our findings align with established epidemiological patterns of CSC and pachychoroid spectrum disorders. A recent meta-analysis reported a CSC incidence of approximately 9.9 per 100,000 in men, compared to 1.7 per 100,000 in women, underscoring the male predominance and potential hormonal influence.⁶ This overlap in risk factors reinforces the plausibility of our findings, even in the absence of a direct control group. Therefore, we believe that the emerging occupational stressors associated with e-sports should be considered within the broader framework of CSC risk stratification and preventive care.

While gaming is commonly pursued for relaxation and entertainment, prolonged and high-intensity competitive gaming among e-sports players may serve as a significant source of psychological stress, potentially resulting in various ocular consequences.^{14–16} Several studies have indicated that excessive involvement in e-sports, particularly its competitive nature, contributes to both physical and psychological health issues.^{17–19} Reported physical consequences include digital eye strain, blurred vision, lower back pain, tension-type headaches, wrist and hand discomfort, and poor posture during gameplay. Psychologically, prolonged gaming has been linked to conditions such as depression, anxiety, apathy, oppositional behavior, increased psychological tension, sleep disturbances, emotional distress, aggression, social withdrawal, and emotional instability.¹⁷ Furthermore, extended online gaming exposure has been associated with an increased prevalence of depression, social phobia, obsessive-compulsive traits, interpersonal hypersensitivity, hostility, phobic anxiety, paranoid ideation, psychotic symptoms, attention-deficit/hyperactivity disorder (ADHD), and gaming addiction.^{17,18}

Anxiety disorders and depression have been proposed as potential risk factors for both the onset and recurrence of acute or chronic CSC.^{4,6,20} Similarly, the potential interaction between elevated stress levels and prolonged screen exposure offers a novel perspective on the pathogenesis of pachychoroid spectrum diseases in contemporary populations. This case series provides valuable insights into these conditions, particularly CSC, within the context of e-sports. A distinct pattern of CSC symptomatology appears among individuals engaged in prolonged gaming, particularly during tournaments or intense gameplay, which coincide with elevated stress levels, potentially contributing to CSC development. Also, e-sports players may develop gaming addiction as a maladaptive coping strategy to mitigate cognitive overload associated with

excessive gaming, which in turn could impose additional physiological stress. Moreover, excessive exposure to blue light may disrupt circadian rhythms, indirectly elevating stress levels and potentially contributing to CSC pathophysiology. Given that lifestyle modifications alone may be effective in managing CSC, as observed in our series, identifying lifestyle factors specific to e-sports players may facilitate the development of targeted preventive strategies. The implementation of stress management strategies—such as mindfulness-based interventions and scheduled breaks—may reduce CSC risk or related symptoms in e-sports players, as observed in many cases within this series. Analogous to collaborations between football clubs, team physicians, and sports medicine specialists, the expertise of CSC specialists may become increasingly important in delivering tailored healthcare support to e-sports players. On the other hand, many of the patients actively streamed their gameplay on *Twitch*, which may have further heightened their stress levels.^{19,21} Streaming requires not only high-level gameplay but also constant interaction with viewers, adding an additional psychological burden to perform and sustain an audience. The dual responsibility of high-level competition and live audience management likely exacerbates psychological strain, potentially exacerbating risk factors associated with CSC. Future studies should investigate the impact of streaming-related stress on both ocular and systemic health in e-sports players to better understand its role in the development of CSC and other related conditions.

Our case series demonstrates that pachychoroid-related changes may develop or worsen under conditions of sustained stress and prolonged screen exposure. Interestingly, several patients achieved symptom resolution or disease stability solely through behavioral modifications alone—such as reducing screen exposure, improving sleep hygiene, and abstaining from live streaming. This finding aligns with previous literature emphasizing stress reduction and ergonomic interventions as effective non-pharmacological strategies in CSC management.^{7–10,22} Although PDT remains the gold standard for chronic CSC, alternative treatments—including micro-pulse laser therapy, oral eplerenone or acetazolamide, and topical corticosteroids or nonsteroidal anti-inflammatory agents—have been reported to reduce SRF, particularly in the absence of verteporfin and in cases where PDT is declined.^{1–4,6} However, the long-term efficacy of these treatments on BCVA remains controversial.^{1–4,6} In our report, we recommended advanced imaging followed by PDT for Patients 1 and 3. However, as they declined this option, we proceeded with other debated treatment approaches.

Although multimodal imaging—including FFA and ICGA—was recommended for all patients, these tests were not performed due to patient refusal. All participants expressed significant concern regarding the invasive nature

and potential side effects of these procedures, particularly after independently researching their risks online. Despite detailed counseling, informed consent for FFA and ICGA could not be obtained. Consequently, diagnoses were based on non-invasive imaging modalities, including spectral-domain OCT, OCT angiography (when applicable), red-free fundus imaging, and clinical examination. This limitation is acknowledged, but reflects a real-world clinical scenario, especially among digitally literate patient populations with high medical awareness and preference for non-invasive diagnostics.

This case series reports on CSC patients who self-identified as active e-sports players and were consecutively evaluated in our clinic. While we attempted to reduce clinical heterogeneity by excluding cases with systemic comorbidities, ocular disease, corticosteroid use, or psychiatric illness, we acknowledge that individual-level behavioral and psychological confounders—including sleep disturbances, coping mechanisms for stress, and intensity of gaming—may have influenced disease manifestation. Future prospective studies with broader cohorts and standardized psychometric tools are warranted to explore these associations in more depth.

This case series has several limitations. First, multimodal imaging was limited to OCT, OCTA, red-free imaging, and fundus photography. Also, the absence of FAF images represents a limitation of the report. Second, treatment evaluation was restricted as micropulse laser therapy and PDT were recommended to Patients 1 and 3, but both declined, preventing an assessment of its potential effects. Additionally, subfoveal choroidal thickness measurements were performed at a consistent time (09:00–10:00 AM) by 2 researchers, with mean values used for analysis to enhance reliability. However, uncontrolled systemic or environmental factors may have introduced bias. Third, while patients engaged in prolonged gaming and reported esports-related stress, individual stressors were not quantitatively assessed, potentially confounding the observed effects. We also sought to include patients' gaming nicknames or *Twitch* streaming identities to raise awareness, but privacy concerns led all participants to decline this request. Furthermore, the lack of a control group and the selected nature of our sample limits generalizability. Another limitation is that this study exclusively included individuals who played on personal computers, highlighting the need for future research on users of other gaming platforms, such as consoles (*Xbox*, *PlayStation*) or virtual reality systems. Additionally, the influence of gaming genres on CSC incidence remains unexplored and warrants further investigation. The distinction between casual gamers, who engage in sporadic leisure gaming, and e-sports professionals, who follow structured and high-frequency gaming schedules, constitutes a significant gap in the existing literature. Future studies should aim to investigate potential retinal and choroidal

structural differences between these 2 populations. Finally, larger-scale studies with comprehensive stress assessments and standardized environmental controls are needed to better understand the association between gaming, stress, and choroidal parameters. Future research could also explore the impact of lifestyle factors such as sleep deprivation and nutrition on CSC in e-sports players. Given that professions involving prolonged computer work—such as those of computer engineers, researchers, and gamers—are prone to higher stress levels, further studies are needed on this subject. Also, controlled studies are warranted to evaluate potential differences between conventional CSC and CSC potentially induced by e-sports-related stress. These findings may contribute to evidence-based recommendations tailored to the unique physiological demands of professional e-sports players, ultimately enhancing both ocular health and gaming performance.

Conclusion

This case series suggests a possible association between competitive e-sports participation and the development of CSC, potentially mediated by chronic psychological stress and prolonged screen exposure. Notably, clinical improvement and disease regression were observed in several patients following targeted lifestyle modifications. These findings underscore the importance of early ophthalmologic screening and the implementation of stress-reduction strategies in this emerging at-risk population. Understanding whether e-sports-related CSC represents a distinct clinical phenotype or simply reflects a modern trigger of a well-established disease process remains an open and clinically relevant question. Further controlled studies are warranted to investigate this association in greater depth and to clarify the underlying mechanisms linking digital behaviors with CSC pathophysiology.

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Author contributions

Conceptualization, M.C.S., I.G., F.G., E.H.C.v.D., P.R., Y.S.; methodology, M.C.S., I.G., F.G., E.H.C.v.D., P.R., Y.S.; Collecting data, analysis, investigation, resources, data curation, M.C.S., I.G.; writing—original draft preparation, M.C.S., I.G., F.G.; writing—review and editing, M.C.S., I.G., F.G., E.H.C.v.D., P.R., Y.S. All authors have read and agreed to the published version of the manuscript.

Declaration of conflicting interests

Author Y.S. declares to have received speaker fees from Bayer and Roche, and to be the inventor of a patent related to age-related macular degeneration (biomarkers of polypoidal choroidal vasculopathy, patent no. DK179993B1, <https://patents.google.com/patent/DK179993B1/en?q=DK179993B1>), all of which are not directly related to this work. Other authors declare that no potential conflicts of interests exist in relation to this work.

Ethics

Written informed consent was obtained from the patients.

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Supplemental material

Supplemental material for this article is available online.

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