Central serous chorioretinopathy (CSC) is an idiopathic disorder characterized by serous retinal detachment and retinal pigment epithelial detachment (PED). Changes are most often confined to the macula and are associated with leakage of fluid through the retinal pigment epithelium (RPE) into the subretinal space. Patients with CSC often experience loss of central vision, central scotoma, micropsia, metamorphopsia, decreased color vision, and abnormalities in contrast sensitivity. Visual acuity may be only moderately reduced, and there may be a hyperopic shift.1

This article reviews some of the basics about this condition, including associated risks, pathophysiology, and available treatment options.

**RISK FACTORS FOR CSC**

Numerous risk factors have been associated with CSC, the most consistent being glucocorticoid use. In a case-control study of 312 patients with CSC, Haimovici et al reported an odds ratio of 10.3 for corticosteroid use.2 In another study of 230 patients, Tittl and colleagues reported an odds ratio of 3.17, supporting this association.3 CSC is also associated with elevated levels of endogenous corticosteroids, as in Cushing syndrome.4 Given the strong association between CSC and steroids, their use should be avoided whenever possible. Furthermore, patients with CSC should be questioned about their use of all forms of steroids, including products that may contain steroids (eg, skin creams, joint injections, nasal sprays, inhalants, and other commonly overlooked forms of glucocorticoid), as these could be contributing factors.

Pregnancy is a recognized risk factor for CSC. Plasma cortisol levels are elevated during pregnancy, particularly during the third trimester.5 Pregnancy-associated CSC tends to present as white subretinal exudation that usually resolves spontaneously after delivery.6

Another risk factor traditionally associated with CSC is psychological stress and type A personality. Yannuzzi’s well-known study of CSC and personality types supports this association.7 Other associations include systemic hypertension, gastroesophageal reflux disease, and the use of alcohol or sympathomimetic agents, although this last requires further confirmation.2,8,9

**PATHOPHYSIOLOGY**

The pathophysiology of CSC is poorly understood. Some postulate that a focal increase in permeability of the choriocapillaris overwhelms the overlying RPE, producing serous PEDs and subretinal fluid.10 Guyer and colleagues suggested that the...
pathogenesis of CSC may be choroidal vascular hyperpermeability with or without associated active pigment epithelial leaks or PED. An alternative theory suggests that CSC results from ion pump dysfunction in the RPE, resulting in reverse fluid movement in a chorioretinal direction.

Recent progress in retinal imaging with enhanced depth imaging OCT (EDI-OCT) and swept-source OCT (SS-OCT) technologies has provided new insights and enabled precise structural and functional analysis of the choroid. Increased choroidal thickness and dilated choroidal vessels on EDI-OCT and choroidal hyperpermeability on indocyanine green angiography (ICGA) supports the role of the choroid in this disease. Further evidence for choroidal vasculopathy in CSC comes from studies indicating that areas with midphase inner choroidal staining also have delayed choroidal filling, suggesting choroidal lobular ischemia with associated areas of venous dilatation.

Pachychoroid Disease

In 2013, Warrow et al reported a series of patients with RPE changes in one or both eyes that resembled those frequently seen in the fellow eyes of patients with unilateral CSC. The authors suggested that these RPE changes occurred in the absence of serous detachment but were related to a spectrum of choroidal abnormalities seen typically in CSC eyes. The term *pachychoroid pigment epitheliopathy* (PPE) was introduced to describe this entity, which these authors considered to be a forme fruste of CSC.

The authors demonstrated that the RPE changes in PPE could be attributed to foci of choroidal thickening, as seen on OCT, and choriocapillaris hyperpermeability, as seen on ICGA. They also showed that some changes had developed directly over large, dilated choroidal vessels directly external to the RPE/Bruch membrane complex. Shortly thereafter, pachychoroid features were described in eyes with a wider spectrum of disease, including CSC, pachychoroid neovasculopathy (PNV), polyoidal choroidal vasculopathy (PCV), and focal choroidal excavation.

Proposed Role of Inner Choroidal Ischemia

En face OCT imaging in a cohort of patients with pachychoroid disease revealed that focal choroidal thickening could be attributed to pathologically dilated Haller layer veins (referred to as *pachyvessels*), and, where tissue manifestations occurred at the level of the RPE, paradoxical thinning of the inner choroid (choriocapillaris and Sattler layer) could be appreciated, resulting in anterior displacement of pachyvessels into close proximity to Bruch membrane.

These changes formed the basis for the hypothesis that choriocapillaris attenuation may produce an ischemic milieu that is causative or contributory to type 1 neovascularization. Gal-Or and colleagues studied zones of reduced inner choroidal flow signal, foci of reduced inner choroidal thickness, and pathologically dilated Haller layer vessels in eyes with pachychoroid disease using OCT angiography (OCTA). They found a high prevalence of large flow signal attenuation zones in eyes with pachychoroid disease that correlate with pachyvessels, and they proposed that inner choroidal ischemia could be related to the pathogenesis of pachychoroid diseases.

Other Hypotheses

Some authors have proposed that pachychoroid could be an inherited condition with potentially dominant transmission mode. Weenink and colleagues found CSC-like pathology in 14 of 27 (52%) families of patients with chronic CSC. Only a small percentage of affected relatives reported symptoms. In a prospective observational study, Lehmann et al found that 50% of eyes from first or second-degree relatives of five patients with CSC had thick choroids.

**TREATMENT TALK**

Acute CSC is typically a self-limited process. Recovery of visual acuity typically occurs within 1 to 4 months, coinciding with reattachment of the neurosensory retina, with few recognized visual sequelae. Recurrences are common, happening in approximately 30% to 50% of patients by 1 year. Patients with frequent recurrences or with chronic neurosensory retinal detachment may develop RPE atrophy and neurosensory retinal changes that result in permanent loss of functional vision. The terms *acute* and *chronic* (fluid persisting > 3 months) will be used in this discussion.

Observation is the standard initial management in patients with acute CSC, but there are instances when treatment may be desirable. These
instances include CSC with persistent macular subretinal fluid (SRF) or reduced visual acuity, cases in which rapid recovery of vision is required for vocational reasons, and those in which untreated CSC has resulted in a poor visual outcome in the fellow eye.

**Laser Therapy and Photodynamic Therapy**

Focal laser photocoagulation is commonly used to expedite SRF absorption in acute and chronic CSC. Typically, laser burns are applied to areas of focal leakage identified by fluorescein angiography (FA) as the principal sources of SRF. Treatment of these leaks usually leads to SRF resolution; however, in rare instances, laser photocoagulation may be associated with persistent scotoma at the site of photocoagulation and choroidal neovascularization (CNV). Thus, laser photocoagulation is not recommended if the point of leakage is within or near the foveal avascular zone.

Other types of laser delivery may also be efficacious in treatment of CSC. Micropulse laser delivery mode (Figure) diminishes the risk of iatrogenic thermal damage because it does not induce visible laser burns and can therefore be used to treat subfoveal or juxtafoveal focal and diffuse leaks. Photodynamic therapy (PDT) with the light-activated drug verteporfin (Visudyne, Bausch + Lomb) has been effectively used to treat chronic CSC. Potential advantages of micropulse laser over PDT include lower cost and no adverse events associated with PDT infusion (eg, transient reduction in macular function, choroidal nonperfusion, RPE atrophy, and CNV).

Roca et al conducted a multicenter retrospective comparative study of 159 consecutive eyes with chronic CSC treated with either yellow micropulse laser or half-dose verteporfin PDT. The main outcome measures were BCVA and central macular thickness (CMT) at 12 months. A probability value of less than .05 was considered statistically significant.

At 12-month follow-up, mean BCVA improved in the micropulse group from logMAR 0.41 ± 0.27 at baseline to 0.21 ± 0.26 (P < .0001). In that group, 48.9% (45/92) of eyes had improvement of 3 or more lines, 48.9% (45/92) of eyes remained within 2 lines of baseline, and 2.2% (2/92) of eyes lost 3 or more lines from baseline. There were no adverse events attributable to yellow micropulse laser.
benefit of melatonin treatment for chronic CSC. These authors compared melatonin 3 mg three times per day (9 mg/day) in 13 patients versus placebo in five patients. At 1-month follow-up, BCVA significantly improved in 87.5% of treated patients (seven of eight patients) \( (P < .05) \). All patients showed significant reduction in CMT \( (P < .01) \), and three patients (37.5%) exhibited complete resolution of SRF. No significant side effects were observed, and no changes in BCVA or CMT were noted in the placebo group. \(^{33}\)

**Anti-VEGF Therapy**

Anti-VEGF agents are not considered first-line treatments for either acute or chronic CSC because aqueous VEGF levels are not elevated in these patients. Anti-VEGF therapy is, however, useful in patients in whom secondary CNV develops.\(^{26}\)

**CONCLUSION**

Advances in imaging techniques have improved our understanding of the choroid and choroidal disorders. Management of CSC is challenging, particularly chronic CSC. Although focal laser and PDT are current standards of care in chronic CSC, micropulse laser is a good alternative in instances when verteporfin is not available. Some systemic treatments may benefit patients with chronic CSC by decreasing the rate of therapy-induced complications. \(^{1}\)


**GLOBAL PERSPECTIVES**


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