

# Central serous chorioretinopathy: from glucocorticoids to light intensity

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## Abstract

• **Central serous chorioretinopathy (CSC) is characterized by a localized accumulation of subretinal fluid and an idiopathic focal leakage from choroidal vessels. The exact pathogenesis of CSC, however, still remains obscure. In this paper, we hypothesized that CSC may result from a response of choroidal vessels to an acute increase in the environmental light intensity leading to a focal leakage from the choroidal vessels. High levels of glucocorticoids, in our proposed model, may cause persistence rather than initiation of the focal leakage, probably by suppressing the synthesis of collagen and extracellular matrix components and inhibiting fibroblastic activity.**

• **KEYWORDS:** central serous chorioretinopathy; glucocorticoids; light intensity; temperature; choroidal vessels

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## INTRODUCTION

Central serous chorioretinopathy (CSC) is a localized serous retinal detachment characterized by an idiopathic focal leakage in fluorescein angiography<sup>[1]</sup>. Yet, the exact pathogenesis of CSC still remains obscure, its natural course has not been completely understood, and its treatment has not been clearly defined. Identifying risk factors of CSC may be helpful to predict its natural course and to institute more efficient interventional strategies. Attempts continue to identify possible risk factors of CSC<sup>[1]</sup>.

## ROLE OF GLUCOCORTICOIDS

It has been reported that the accumulation of subretinal fluid in cases with CSC is associated with high levels of glucocorticoids, whether endogenous hypercortisolism or exogenous administration of glucocorticoids<sup>[2]</sup>. However, the mechanisms by which glucocorticoids have been implicated in the pathogenesis of CSC still remain unclear<sup>[2]</sup>. Reviewing the actions of glucocorticoids such as inhibition of fibroblastic activity<sup>[3]</sup> and suppression of the synthesis of collagen<sup>[4]</sup> and extracellular matrix components<sup>[5]</sup> may provide new insights into the pathogenesis of CSC. Collagen is the main component of Bruch's membrane. Suppression of the synthesis of collagen and extracellular matrix components and inhibition of fibroblastic activity may decelerate any reparative process in damaged choroidal circulation leading to a persistent choroidal leakage. It may be a probable mechanism which explains the role of glucocorticoids in the pathogenesis of CSC. Therefore, high levels of glucocorticoids may cause persistence rather than initiation of the focal leakage into the subretinal space, probably by suppressing the synthesis of collagen and extracellular matrix components and inhibiting fibroblastic activity.

## A NEW INSIGHT

In this paper, we hypothesized that CSC may result from a response of choroidal vessels to an acute increase in the environmental light intensity. The increase in the light intensity may lead to increase in the choroidal temperature particularly at the focal point of the irradiating lights into the eye. The resultant focal heat may induce focal damages of choroidal vessels leading to a focal leakage from the choroidal vessels. The focal damages may be repaired spontaneously. However, high levels of glucocorticoids may decelerate the reparative process leading to the persistent focal leakage into the subretinal space.

## DISCUSSION

The exact initiator of the focal leakage into the subretinal space, in CSC cases, remains obscure, and it needs to make new hypotheses which may be helpful to find out the initiator of the focal leakage from the choroidal vessels. Evidences have shown that choroidal vessels are dilated in CSC<sup>[6-7]</sup>. These data as well as epidemiologic reports shown that macula is mainly affected in most cases of CSC<sup>[1,8]</sup> may provide new insights into the pathophysiology of CSC<sup>[9]</sup>. Macula is at the focal point of the irradiating lights into the

eye. Most of the light energy is absorbed by pigments of retinal pigment epithelium (RPE) and choroid leading to increase in the temperature of the macula and the submacular choroid [10]. Choroidal vessels act as a thermoregulator of macula [11]. Therefore, an increase in the temperature of the macula results in choroidal vasodilation [12-14]. We hypothesized that if the choroidal vessels dilate acutely and severely, it may lead to a leakage through relatively thin choroidal vascular walls.

An increase in the environmental light intensity increases the temperature of the macula. If the focal heat is high enough to induce severe choroidal vasodilation but not to burn the tissues, and if the rate of heat accumulation is higher than the rate of adaptation of choroidal circulation to bright lights, it may initiate a focal leakage from the dilated choroidal vessels. The focal point (s) of the leakage, thereafter, are mostly repaired spontaneously.

The hypothesis may predict that in geographic locations with climatic variations, CSC incidence may increase at the beginning of spring. It is consistent with epidemiologic data showing that there is a seasonal variation in the occurrence of cases with an increase in the months of March and April [15]. Furthermore, it may be expected, based on the hypothesis, that CSC incidence is high in geographic locations with bright natural light. However, retinal adaptation to bright light in individuals resident in one location for a long time should be considered. Changes in environmental light intensity may play an important role in CSC development rather than the mean environmental light intensity. An estimated incidence of CSC comes from a population-based study in Olmsted County, Minnesota, USA. Mean annual incidence was 9.9 per 100 000 in men, and 1.7 in women, from 1980 to 2002 [16]. Another population-based study in Taiwan reported an incidence of 27 per 100 000 in men and 15 in women, from 2001 to 2006 [8]. The geographic latitude of Taiwan is 23-25° N, while that of Olmsted County is 43.8-44.2° N. Taiwan has two distinctive seasons; hot and cool, mostly with tropical and sub-tropical climates, whereas most days per year in Olmsted County are not sunny. Although many factors might influence the incidence of CSC in these two parts of the world, the difference can be explained, and expected, using our hypothesis. However, lack of population-based studies may make it difficult to compare the incidence of CSC in different geographic locations [17-18].

Solar eclipse viewing may provide insights into the pathophysiology of CSC supporting the hypothesis. In these cases, light intensity and duration of light exposure may be the dominant factors that determine whether CSC occurs or not. A high light intensity and a long exposure time may lead to photochemical damage of retinal structures without developing the characteristic features of CSC [19]. However, it seems that light damage to the retina is not a singular event

that develops a unique set of abnormalities [20]. It may result in a spectrum of abnormalities depending on various determinant factors such as luminance, exposure time, and adaptive states of the retina to environmental light. If luminance and exposure time are not as high as those developing typical solar eclipse retinopathy, it may result in CSC development [21]. Nevertheless, the role of glucocorticoids should not be overlooked in cases with solar retinopathy. High levels of glucocorticoids, in these cases, may shift retinal features toward CSC [22]. Furthermore, experimental studies evaluated extravascular plasma leakage after the retinal exposure to intense visible light by immunostaining of serum albumin. The results showed a plasma leakage originating from choriocapillaries through RPE, and the leakage was only observed in the central retina affected by light, but not in the peripheral retina, which was preserved after light exposure [23].

If the hypothesis is proved to be correct, it may be helpful to design more efficient strategies to prevent and manage CSC. Further experimental studies and clinical investigations are needed to assess the risk of acute increases in environmental light intensity in CSC development and progression.

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