

Mini Review on the Effect of Smoking on Retrobulbar Blood Flow in Thyroid Eye Disease

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Abstract

In the last decade, retrobulbar haemodynamic changes due to cigarette smoking and various disease have attracted a considerable amount of attention. In this mini review, we overview the recent studies and their conflicting data on the effect of cigarette smoking on retrobulbar vascular velocity in patients with thyroid eye disease and also healthy smokers.

Keywords: AndosanTM; Agaricus blazei; Allergy; Inflammation; IBD

Introduction

Thyroid Eye Disease (TED) is an autoimmune inflammatory disorder with multiple clinical signs including proptosis, eyelid retraction, orbital congestion, chemosis. Cigarette smoking is a known risk factor for atherosclerotic changes in several organs [1]. Endothelial dysfunction might have a role in the pathogenesis of smoking-related disease [2,3]. The cytotoxic effects of free radicals found in cigarette smoke speed up smoking-induced disease mechanism [4].

Autoregulation is the ability of the vessels to maintain constant blood flow despite a moderate change in perfusion pressure [5]. Metabolic autoregulation which is known as vascular reactivity is the ability of vasculature to maintain a relatively constant level of O₂ and CO₂. Normal retinal vessels constrict in response to O₂ and vasodilation is a reaction to CO₂ [6]. Previous studies have shown the reduced ability of retinal vasculature autoregulation in smokers [7-9].

Colour Doppler Imaging (CDI) is a non-invasive sonographic technique that assesses blood flow velocity in vessels. This method also has been used to measure retrobulbar and ocular blood flow in the various ophthalmic disorders such as ocular ischemic syndrome, CRVO, diabetes, glaucoma [10-13].

Colour Doppler Parameters in TED

In patients with TED, few studies have measured the retrobulbar blood flow parameter by using colour Doppler imaging [14-23].

Decreased sup ophthalmic vein (SOV) blood flow velocity has been documented in previous studies [14-18]. Somer et al. [23] reported that decreased SOV flow velocity is related to apical crowding in the ct scan. However, Alp et al. [14] didn't find a correlation between SOV blood flow and muscle index. Correlation between reduced venous outflow and clinical activity score (CAS) was noted in previous studies [14,19]. Also some previous study mentioned a reverse flow in SOV in TED with dysthyroid optic neuropathy [14,16].

Although reduction in superior ophthalmic vein flow rate is a well-established feature in ted, but previous studies showed conflicting data on the flow rate of CRA and OA [21,24]. Yanik et al. reported high arterial flow velocities and lower resistance index of the OA of patients with high clinical activity score [19]. Lopez et al. [21] reported a higher RI in the CRA and OA in patients with TED compare to control group, but in opposite Benning et al. did not observe any difference [25].

Lopez and co-workers also measured retrobulbar hemodynamic changes after bony decompression [21]. They found a higher resistance index (RI) in the central retinal artery (CRA) and ophthalmic artery (OA) in patients with inactive moderate to severe TED that significantly decreased after surgery. They concluded that High RI is due to compression of the vessel caused by raised retrobulbar pressure In TED, in contrast. In another study Alp, MN and co-worker's reported that changes in blood velocity are secondary to inflammation, not compression [14].

Effect of Smoking on Retrobulbar Blood Flow in TED

Cigarette smoking is a well-known risk factor that increases severity and incidence of TED. By using colour Doppler imaging Sadeghi-Tari et al. [26] reported the role of smoking on retrobulbar blood flow. In their study maximum and minimum venous pressure of SOV was significantly lower in smokers; however, authors didn't find a significant difference in colour Doppler parameters of OA and CRA, CRV, between smokers and non-smokers. Smoking might play an independent role in venous congestion in TED [26].

Effect of Smoking on Retina and Optic Nerve Circulation in Healthy Smokers

Robinson et al. [27] reported that macular leucocyte velocity in smokers was increased by 12% immediately after smoking. The effect of smoking on ocular circulation depends to the duration of smoking In rabbits, the acute effect of inhalation of cigarette smoke was reduced choroidal blood flow by about 20% [28], but after chronic inhalation (16 or 25 weeks) of smoke, choroidal blood flow showed no significant change [29].

The effect of smoking on ocular blood flow depends on the length of smoking history. Using the laser speckle method in light smokers whose smoking history was less than 2 y, Tamako et al. [30] reported no significant change of optic nerve head circulation but significant decrease of retina and choroid circulation after smoking. On the other hand they found increased tissue blood velocity in the optic nerve head in smokers with more than 10 y of smoking [31].

In contrast, some studies reported decreased blood velocity in the ophthalmic artery [32], and central retinal artery and posterior ciliary artery [33] in smokers.

Chronic smoking might decrease choroidal vascular vasodilation in response to carbogen inhalation compared to non-smokers, whereas normal response was seen in the retina and optic nerve vessels, reported by Wimpissiger et al. [34].

In smokers and non-smokers controls, retinal blood flow during breathing of 100% oxygen was assessed with laser Doppler velocimetry, in both groups, retinal blood flow decreased, more pronounced in smokers that indicate abnormal vessel response to hyperoxia [35].

By using laser Doppler velocimetry, Garhofer et al. [36] reported impaired retinal vein vasodilation in response to flicker light compared to non-smoker volunteers.

Conclusion

Little is known about the haemodynamic effects of cigarette smoke on Retrobulbar and ocular blood flow in patients with TED. There is some evidence that retrobulbar vascular velocity is different in non-smokers than chronic smokers. Cigarette smoking may have an independent role in haemodynamic changes of orbit in patients with TED.

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