



## Pathological Changes of the Visual Analyzer in Metabolic Syndrome

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**Abstract:** Metabolic syndrome is becoming a worldwide challenge for medicine and public health, as its prevalence has been increasing over the years. Age-related eye diseases, which are the leading cause of blindness worldwide and visual impairment in developed countries, are also on the rise due to an aging population. It has been shown that many of the individual components of the metabolic syndrome are associated with these eye diseases. However, the relationship of metabolic syndrome with eye diseases is not clear. In this review, we examined the links between metabolic syndrome and some eye diseases in the population. We also examined the relationship of individual components of the metabolic syndrome with eye diseases due to a lack of research in this area. In addition, we have also summarized the current understanding of the etiological mechanisms of how metabolic syndrome or individual components lead to these eye diseases. With the increasing amount of data on such associations, it may be important to identify patients who are at risk of developing metabolic syndrome, since rapid treatment and intervention can potentially reduce the risk of developing certain eye diseases.

**Keywords:** metabolic syndrome, retina, retinopathy.

### Introduction.

Metabolic syndrome becomes a risk factor for the body as a whole and thereby poses a challenge to public health, as its prevalence increases over the years. This syndrome includes several changes in the body, these are dyslipidemia, cardiovascular changes, type 2 diabetes mellitus and cerebrovascular diseases. The World Health Organization recognizes metabolic syndrome as a "pandemic of the XXI century". The prevalence of metabolic syndrome is 20-40%. According to the results of the INTERHEART study, an average of 26% of the adult population of the planet suffer from metabolic syndrome. 40% of the population have 2 components of the metabolic syndrome, 11% have 3 or more of its components. The syndrome is more common in middle-aged and older people (30-40%). Obese patients with metabolic syndrome account for 49%; impaired glucose tolerance in metabolic syndrome is 50%, and in diabetes mellitus 80%. Changes in the body with metabolic syndrome are of high importance for early diagnosis and treatment, as well as timely prevention of complications. Cardiovascular diseases with metabolic syndrome account for a large mortality rate with persons without metabolic syndrome. The development of diabetes mellitus and hypertension also increases 3-6 times with metabolic syndrome. Vital organs such as kidneys, heart, blood vessels are affected. Impaired filtration function of the kidneys, impaired permeability of vascular walls, microalbuminuria, thickening of artery walls cause complications in metabolic syndrome. Thus, early detection of metabolic syndrome is based on early prevention of diabetic complications, vascular atherosclerosis and its consequences. According to WHO, the number of

patients with metabolic syndrome is 2 times higher than the number of patients with diabetes mellitus, and their number is also expected to increase by 50% in the next 20 years. It should be emphasized that Patients with metabolic syndrome are people of working age who are very important for social society. In addition, over the past two decades, the frequency of the syndrome under study has shown a steady increase among young people.

**Materials and methods.** During the literary review, the resources of the PubMed and eLibrary search engines were used for the last 10 years. In this literature review, articles containing clinical and experimental data were used. For this analysis, we used articles containing evidence-based experimental and clinical data on the most up-to-date issues related to the epidemiology, etiology and pathogenesis of eye diseases in metabolic syndrome.

**The purpose of the work:** To analyze literary articles about changes in the visual analyzer in metabolic syndrome. Prevalence of the disease, causes, pathogenetic changes.

**The main part.** Metabolic syndrome affects the functions of the visual analyzer. Several studies have studied the relationship of metabolic syndrome with microvascular changes in the retina, age-related macular degeneration of the retina, cataracts, glaucoma. . Zhao et al. found that in patients with metabolic syndrome, arteriovenous intersections, focal narrowing of arterioles, enhanced reflex of arteriole walls, retinopathy and a decrease in the diameter of arterioles are more often observed[1]. Saito et al. A narrower diameter of retinal arteries and a wider diameter of retinal veins were also found in patients with metabolic syndrome [2]. Similar data were also obtained in a study conducted by Wong et al. on 11,265 people in the USA [3] and in studies by Kawasaki et al. in Japan [4]. Some other key studies have also shown a significant association between diabetes and glaucoma [6,7,8,9]. A recent statistical analysis published in 2015 reported the relative risk of glaucoma in people with diabetes compared to those who did not have metabolic syndrome [10]. In a study of nurses' health, this is 76318 women aged 40 years and older, Pasquale et al. found that women with diabetes are 1.82 times more likely to develop primary open-angle glaucoma [11]. However, several other studies, including the Rotterdam study, have not found any significant association between diabetes and glaucoma [12,13,14,15]. In one of the studies, Welinder L.G. et al. It has been reported that the strength of the association between diabetes and glaucoma does not depend on the level of glycemic control [16]. Stoyanov et al. It was reported that patients with metabolic syndrome had significantly higher intraocular pressure, and this may be associated with retrobulbar obesity and changes in internal vessels [17]. In the Rotterdam study by Ramdas et al. It was found that obesity in women was associated with intraocular pressure, but there was a 7% reduction in the risk of developing open-angle glaucoma [18]. It has been suggested that the actual intraocular pressure may be overestimated in obese women because their chest and abdomen were pressed against the slit lamp table when using the Goldman lens. Another reason is that high estrogen levels and hormone therapy can protect against open-angle glaucoma [11,19]. Gasser et al. no statistical difference was found between glaucoma patients with metabolic syndrome and the control group [20]. Hypertension causes open-angle glaucoma due to increased perfusion of the ciliary artery, which leads to an increase in water production [22,23]. The second possibility is that atherosclerotic vessels feeding the optic nerve can lead to glaucomatous changes [24]. There is no clear link between dyslipidemia and glaucoma. However, statins have been found to increase the ability of watery moisture outflow, and other studies have shown that individuals treated for hyperlipidemia have a reduced risk of open-angle glaucoma [25,26,27]. Obesity may be associated with open-angle glaucoma, since excess orbital fat and increased blood viscosity can increase episcleral venous pressure and reduce the outflow of watery moisture and, thus, increase intraocular pressure [28-32]. Hyperlipidemia can also lead to oxidative stress and affect the function of the trabecular network [33,34]. Also, a 2014 study conducted by Kawashima et al. on 672 Japanese showed that the volume of lacrimal fluid was significantly reduced in patients with metabolic syndrome, while lacrimal gland hypofunction was more common in this particular group [5]. Sarah B Wang et al. in their study, they studied the relationship between the individual components of the metabolic syndrome and the retinal vascular network. Retinal arteriole gauge narrowing has been associated with hypertension, large waist circumference, and high triglyceride levels, suggesting that these specific factors may be driving the

link between metabolic syndrome and changes in retinal vascular caliber. Changes in the microcirculatory bed of the retina can be a useful biomarker, since they can be detected at earlier stages of the pathological process compared with the assessment of the risk of cardiovascular diseases using coronary angiography and other traditional assessments [37]. According to the results of research by Ja K. Gu et al. They showed a significant relationship between the metabolic syndrome and the diameter of retinal microvessels in the general population and in the group diagnosed with a certain disease. In the study, they focused on the relationship between blood pressure and the diameter of retinal microvessels. The present study expanded this study by drawing attention to the relationship of metabolic syndrome with the diameter of retinal microvessels. The results of the analysis showed that the metabolic syndrome is largely associated with the diameter of the retinal microvessels. During the study, it was found that the diameter of retinal arterioles narrows and the diameter of retinal veins increases in metabolic syndrome [38]. In studies by Y.Yuan et al. Associations between the retinal vessel gauge and individual components of the metabolic syndrome are also considered. In the component analysis, participants with a narrower gauge of retinal arterioles were more likely to have central obesity, dyslipidemia or high blood pressure and less likely to have elevated fasting plasma glucose levels [39]. Wygnanski-Jaffe et al. It was found out that with metabolic syndrome, intraocular pressure also rises and thereby entails glaucoma and optic nerve atrophy [40].

**Conclusion.** It can be seen from the literature review that the metabolic syndrome is closely related to pathological changes in the visual analyzer, and also the study of the eyeball will allow us to find the relationship between the metabolic syndrome and visual changes, which will allow us to diagnose metabolic changes in the body in a timely manner and start treatment processes in a timely manner.

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