

SMOKING INCREASES THE RISK OF NORMAL TENSION GLAUCOMA

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PURPOSE

To determine whether smoking and systemic circulatory diseases have any role in the pathogenesis of chronic glaucoma.

METHOD

66 established chronic glaucoma patients were randomly selected from our clinic for this study. Chronic glaucoma patients were separated into high tension glaucoma (HTG) in which intraocular pressure(IOP) were above 22 mmHg by applanation and normal tension glaucoma(NTG) in which intraocular pressures were below 22 mm. By differentiating these two types of glaucoma, we may be able to know if smoking and systemic diseases play any role in each type.

A list of circulatory diseases was selected which could either result in decreased blood supply (ischemia) or decreased oxygenation (hypoxia) to the optic disc. The list included the following: hypertension, ischemic heart disease including history of angioplasty or heart bypass surgery, cholesterol level, carotid artery disease, diabetes, circulatory problems such as migraines and Raynaud's disease, respiratory problems including emphysema and COPD, smoking including exposure to second hand smoke, chronic anemia, inflammatory vascular diseases and rheumatoid arthritis and also about their refractive errors.

History regarding smoking including second hand was taken from every chronic glaucoma patient. History included the number of years of smoking and the number of cigarettes smoked per day. Only long term smokers of over 10 years were included in the study. Similarly, in the case of second hand smoke, only those patients who had long term exposure either at home or at work were included in the study. History of the above mentioned systemic circulatory diseases was also taken from all glaucoma patients. In the case of an established glaucoma patient, but new to our clinic, glaucoma medications were discontinued for about 10 days in order to determine the untreated baseline intraocular pressures. If their baseline IOP were found to be above 22 mmHg by applanation, they were classified as having high tension glaucoma whereas if their IOP were found to be below 22 mmHg , they were classified as having NTG.

During this study, three main tests were performed to confirm the diagnosis of chronic glaucoma. These tests included: (1) Measurement of intraocular pressure by Goldman applanation tonometer (2) Goldman visual field tests and (3) Direct observation of the optic disc with digital fundus camera. Direct observation of the optic disc became extremely important in patients with chronic glaucoma who still had a normal visual field or if their intraocular pressures were within normal range (NTG). During examination of the optic disc, special emphasis was given to the presence of notching, kinking and sloping of the blood vessels at the disc margin. Also the color, size of the neural rim, and nasal displacement of the central retinal vessels to confirm the diagnosis of glaucoma.

RESULTS

Out of the 66 patients, 48 were found to have NTG and 18 having HTG. Out of the 48 patients with NTG, 32 were long term smokers of a pack a day for 30 or more years. Two were exposed to second hand smoke from their spouses who had passed away due to smoking- related conditions. Some of the smokers who had NTG also had smoking- related heart and respiratory problems. The remaining 14 NTG patients were non-smokers. Among these non-smokers, 4 had ischemic heart disease, 2 were anemic with atrial fibrillation, 2 had rheumatoid arthritis, one with diabetes and chronic anemia, 3 with diabetes, one with a heart valve replacement, and one was myopic of -4.00 diopters.

Out of 18 patients with HTG, 4 had no medical problems, 2 were diabetic and hypertensive, one had a heart bypass, diabetes and second-hand smoke exposure, 2 were diabetic and smokers, one with ischemic heart disease and second-hand smoke, one with high cholesterol, one with diabetes and a high myopia of -10.00 diopters, one with chronic traumatic glaucoma, one was a smoker, one was exposed to second-hand smoke, one had emphysema and COPD, one was a smoker with ischemic heart disease, one with emphysema, COPD and exposed to second-hand smoke.

DISCUSSION

This study examined the role of smoking and systemic diseases in high tension glaucoma and normal tension glaucoma separately. Among the 66 randomly selected patients, 48

had normal tension glaucoma (73%) and 18 had high tension glaucoma (27%). This was a significant finding in that a high percentage of chronic glaucoma patients were found to have normal tension glaucoma as compared to high tension glaucoma on the basis of the 22 mmHg cut off level.

Among the patients with NTG, 34 out of 48(78%) were smokers including two being exposed to second hand smoke. All of the patients with NTG had systemic circulatory problems except one patient who had a myopia of -4.00 diopters.

Among the 18 patients with high tension glaucoma 7 were smokers (39%) including 3 who were exposed to second hand smoke. Patients with HTG had fewer medical problems. High tension glaucoma appears to be aggravated by smoking and systemic circulatory diseases. This shows that glaucoma is a multifactorial disease akin to ischemic heart disease. More the risk factors present more the likelihood of development and severity of glaucoma. This may explain that certain patients with ocular hypertension probably do not develop glaucoma because of lack of additional risk factors. On the other hand the NTG patients are developing glaucoma even though their IOP are within normal range.

Among the patients with normal tension glaucoma, a high percentage (78%) were smokers and smoke related heart and respiratory problems. The remaining non-smokers had systemic problems such as ischemic heart disease, chronic anemia, diabetes and one with myopia. The high association of smoking and systemic circulatory problems in

normal tension glaucoma patients suggests that normal intraocular pressure plays a little role in NTG. In other words, NTG may be called a systemic disease. It is interesting to note that the optic disc of NTG patients which had survived for a long time with their normal IOP is now being destroyed with that same normal IOP. This clearly shows that smoking and circulatory diseases have somehow affected the circulation of the optic discs in such a way that even the normal IOP is now acting as high IOP in NTG normal patients.

In this small sample of patients, it appears that HTG and NTG are influenced by multiple factors. The intraocular pressure is only one of the factor which is important in high tension glaucoma and may be not in NTG. Since both HTG and NTG produce the same type of arcuate field defect and glaucomatous disc damage, it appears that all these multiple factors damage some particular area of the optic disc. My hypothesis is that there is compression of the ciliary arteries supplying the border tissue of Elschnig due to direct effect of raised IOP in the case of HTG. Whereas smoking and poor systemic circulation would indirectly impair the ciliary circulation resulting in NTG. Therefore in both HTG and NTG patients the end result would be the same that is chronic ischemia of the border tissue resulting in atrophy. The atrophy of the border tissue would cause loosening and sinking of the optic disc in its entirety.

Once the optic disc begins to sink, the nerve fibers are stretched and cut at the scleral edge which may explain early manifestation of arcuate field defect due to destruction of

the arcuate nerve fibers. This cascade of events would continue until all the nerve fibers are cut at the scleral edge [1, 2]. This study also revealed high myopia as a risk factor which may be due to inherent weakness of the border tissue. In this small sample, the role of smoking and circulatory diseases particularly in normal tension glaucoma is significant and will require further research at a larger scale.

References:

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