

The Role of Plasma Lipid Profile in Patients with Type A Behavior Pattern with POAG

Raffaella Morreale Bubella, Cillino S

Raffaella Morreale Bubella, Cillino S, Section of Ophthalmology, Department of Experimental Biomedicine and Clinical Neuroscience (BioNeC) University of Palermo, Italy

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Correspondence to: Raffaella Morreale Bubella, Section of Ophthalmology, Department of Experimental Biomedicine and Clinical Neuroscience (BioNeC) University of Palermo, Italy.
Email: rmorrealebubella@email.it
Telephone: +39091334376

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ABSTRACT

AIM: To evaluate the lipid profile and the evolution of the damage of the visual field in 2 groups of patients with POAG, one group of patients with type A Behaviour and the other with type B Behaviour. **METHODS:** The study involved 45 patients, 26 women and 19 men, affected by POAG, without significant differences in disease duration. 25 patients presented characteristics of type A behaviour and 20 characteristics of type B behaviour. They are submitted to a complete bio-microscopic examination, tonometry and daily tonometric curve, examination of the visual field through computerized "Octopus 1-2-3" perimeter and determination of the lipid profile (total cholesterol, HDL Cholesterol; LDL Cholesterol, Triglycerides) at time 0 and after 3 years. **RESULTS:** In patients with type A behaviour the values relating to

the single components of the lipid profile both at time 0 and after 3 years proved to be constantly higher in a statistically significant way than those found in patients with type B behaviour and the impairment of the visual field is more serious and that its evolution in time is more marked.

CONCLUSION: The more rapid progression of the damage of the visual field in patients with type A behavior could recognize in the altered profile lipid one of pathogenetic causes.

Key words: Plasma lipide profile; type A behavior pattern; POAG

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INTRODUCTION

Chronic open-angle glaucoma, one of the main causes of visual impairment and blindness worldwide, is today considered a form of progressive optic neuropathy often associated with high intraocular pressure (IOP) consequent on anomalous high resistance to drainage of aqueous humour (AH) through the trabecular meshwork (TM) and Schlemm's channel. Despite in-depth research, the aetiology has not yet been fully clarified, though many authors are favouring more and more the hypothesis of a multifactor pathology, in which an important role is played by both genetic and risk factors.

In the last few years various studies^[1,2] have highlighted the fact that in subjects with POAG the alterations of the lipid profile can indirectly favour not only progression of the visual field deficit through systemic arterial alterations, but also directly with alterations of ocular perfusion pressure, both systolic and diastolic.

In a previous paper^[3] we showed that type A behaviour can be considered a real risk factor for evolution of visual field impairment. The fact is that subjects with such behaviour present marked nycthemeral oscillation of intraocular pressure values, which facilitates neuronal damage and can thwart the most careful therapy. Such patients are also inclined to alimentary abuses, which, in addition to leading them to be overweight, favour the onset of lipid

profile disorders.

We considered it useful to examine the serum values of lipids (cholesterol, HDL-cholesterol, LDL cholesterol and triglycerides) in two groups of patients with POAG, one with characteristics of type A behaviour and one with characteristics of type B behaviour, for the purpose of appraising whether the evolutionary differences in the perimetric damage in the two groups may have a cause in a possible lipid profile disorder.

MATERIALS AND METHODS

The study involved 45 patients, 26 women and 19 men, affected by POAG, without significant differences in disease duration, observed at the Glaucoma outpatient department of the Eye Clinic of the University of Palermo. 25 patients presented characteristics of type A behaviour and 20 characteristics of type B behaviour. The average age of the patients was 64.12 ± 13.5 years without particular differences between the sexes. The patients were submitted to treatment with beta-blockers and/or prostaglandin and/or carbonic anhydrase inhibitors. The study was conducted on the basis of the ethical principles established by the Declaration of Helsinki and informed consent was obtained from all patients. The patients, after determination of type A/B behaviour through a questionnaire in the version modified by the Survey Jenkins Activity, were submitted to the following: (1) Complete bio-microscopic examination; (2) Tonometry and daily tonometric curve; (3) Examination of the visual field through computerized "Octopus 1-2-3" perimeter and evaluation of it through Glaucoma Staging System 2^[4]. We chose this staging method because it is simple and fast; and (4) Determination of the lipid profile (total cholesterol, HDL Cholesterol; LDL Cholesterol, Triglycerides).

All investigations were repeated after 3 years because it is a time interval that could be considered sufficient for an assessment of the role of the type A behavior and of the lipid profile in the evolution of glaucomatous damage.

Statistical evaluation

The data are expressed as average \pm SD. Student's *t*-test was used to evaluate the significance of the data. Values of $p \leq 0.05$ were considered as significant.

RESULTS

In patients with type A behaviour, depicted in table 1, the values relating to the single components of the lipid profile both at time 0 and after 3 years proved to be constantly higher.

Table 2 reports the data (average value \pm SD) relating to the evaluation of the visual field in the two groups of patients through GSS2 at the time zero and after 3 years.

By using the paired-samples Student *t*-test in the patients with type A behavior was found a statistically significant difference ($p = 0.001$) at the time zero and after 3 years; no significant difference was found in patients with type B behavior ($p = 0.18$).

DISCUSSION

The role of vascular risk factors in glaucoma is still under discussion, though hypothesized as long ago as 1999 by Flammer J *et al*^[5] and highlighted, more recently, by the study by Orzalesi and coll^[6], which showed that patients with chronic open-angle glaucoma present a high risk of cardiovascular pathology.

However, there are few studies on the role of atherosclerosis

Table 1 Lipid profile at time 0 and after 3 years.

	Type A	Type B	<i>p</i>
Basal total cholesterol	226 + 2.14	210 + 8.25	0.001
Total cholesterol after 3 years	223 + 7.80	213 + 12.6	0.002
Basal HDL-cholesterol	72 + 6.57	67 + 7.88	0.02
HDL-cholesterol after 3 years	74 + 16.02	66 + 9.79	0.05
Basal LDL-cholesterol	127 + 6.98	116 + 14.54	0.002
LDL-cholesterol after 3 years	125 + 9.81	108 + 13.07	0.001
Basal triglycerides	225 + 15.62	208 + 19.34	0.002
Triglycerides after 3 years	228 + 13.7	214 + 15.02	0.002

Table 2 Variation in the visual field damage in GSS2 in the two groups.

	Type A	Type B
Basal GSS2	2.65 + 0.83	1.55 + 0.97
GSS2 after 3 years	3.09 + 0.75	1.76 + 0.84

in the genesis and evolution of the glaucomatous process; only a recent study by Agafonova VV *et al*^[7] has highlighted a statistically significant relationship between atherosclerosis and the development of pseudoexfoliation glaucoma. Well consolidated in the literature, by contrast, is the relationship between arterial hypertension and intraocular pressure, along with the fact that the latter presents nycthemeral trend superimposed on that of systemic arterial tension^[8,9].

Alterations of the lipid profile and in particular an increase in total cholesterol and LDL-cholesterol, in addition to being frequent in arterial hypertension, can be associated with atherosclerosis both as a systemic disease of the large vessels and in more specific ocular vascular pathology. As stressed by Martinez and coll^[10], in patients with POAG alterations of the ophthalmic artery and the short posterior ciliary arteries detectable in patients with atherosclerosis can in fact determine a diminution of the telediastolic velocity and an increase in vascular resistances to above 0.78 in the ophthalmic artery, involving a risk six times greater of progression of visual field impairment. A statistically significant reduction in flow velocity in the retrobulbar arteries of patients with POAG has been confirmed with Doppler evaluations in other studies^[11].

These alterations in flow involve impairment of perfusion in the head of the optic nerve and have been proposed as a pathogenetic factor for glaucoma^[11]. In fact the increase in vascular resistances could emphasize the reduction in perfusion during the decrease in arterial tension at night, thus increasing hypoxia, with accelerated apoptosis of the ganglionic cells. A statistically significant reduction in the flow velocity in the retrobulbar arteries of patients with POAG has been confirmed with Doppler evaluations in many studies^[10,11].

Moreover, Rader *et al*^[12] and Kerr *et al*^[13] have been able to show the presence in the retinal peripapillary vessels of patients with systemic arterial hypertension a reduction in flow consequent on an arteriolar spasm probably due to vaso-constrictive hypersensitivity. There would therefore seem to be, both in hypertensive and hypotensive peaks, with a different pathogenetic mechanism, a reduction in retinal perfusion. Further, it is well known that in patients with type A behaviour the particularly marked state of anxiety involves greater oscillation of the arterial pressure values both with repeated diurnal peaks and with greater deflection during the night.

The nycthemeral pressure rhythm is due, as highlighted by Smolensky *et coll*^[15], to various factors like environmental temperature, light, noise and feeding behavioural models, ingestion

of liquids and salt and consumption of stimulants. Lastly, a very important role is played by emotional stress, particularly accentuated in patients with type A behaviour^[16]. The fact is that these patients, according to the classical distinction proposed by Friedman and Rosenmann, are characterized by marked and diffused competitiveness, impatience and intolerance towards other people's different rhythms and a tendency to want to obtain a limitless number of things in a limited time period, behaviours that lead to an almost continual state of anxiety and tension. Moreover, in these people, reduced physical activity is documentable, with irregular and very often excessive feeding and the habit of smoking, three conditions that with disorders of the lipid profile involve faster evolution of atherosclerotic lesions^[17].

In a previous study^[3] we highlighted, through the diurnal tonometric curve, the fact that in patients with type A behaviour there are more frequent and larger oscillations in intraocular pressure that repeat in a superimposable way those of the systemic arterial tension.

In our patients with type A behaviour we also noticed impairment of the lipid profile, with a significant increase above all in the fractions (total cholesterol and LDL-cholesterol) most involved in the atherosclerotic process, which remained more or less unchanged during the whole period of observation.

The more marked perimetric damage in such patients and its more rapid evolution, with a statistically significant difference compared to patients with type B behaviour, could therefore perhaps have in arteriolar alterations, linked to the atherosclerotic process, a cause that reduced the effect of the thorough hypotonic therapy to which these patients were submitted in the three years of observation.

On the other hand, it is also well known that Ldl-cholesterol stimulates local production of endothelin -1 with strong vasoconstrictive action on the ciliary arteries, with a further unbalancing of the relationship with nitric oxide, with vaso-dilating action^[18], and deregulation of aqueous outflow through the trabecular meshwork (TM). This hypothesis also seems to be confirmed by other studies emphasizing that the reduction in cholesterol, though at levels initially within the norm, involves a reduction in the risk of developing POAG and a slowing of the evolution of the campimetric damage in affected people^[19]. The role of the impairment of the lipid profile is also underlined by the observation that therapy with statins^[20,21], which markedly influence the reduction in LDL-cholesterol levels, is what ensures the best protection against glaucomatous damage. Some studies, also on particularly vast population samples, have shown that this favourable result might also be due to a direct protective action on the ganglionic cells, which would be added to the action consequent on the reduction in the lipid component of plasma.

From our study, the limitation of which is the low number of samples, it emerges that the more rapid progression of visual field impairment in patients with type A behaviour, could be the resultant of a double pathogenetic process: mechanical and metabolic.

The greater instability of the IOP characteristic of such patients would seem to be responsible for the mechanical damage on the head of the optic nerve while the impairment of perfusion, consequent on the atherosclerotic alterations with accentuated reduction in perfusion, especially at night, could favour the process of apoptosis of the ganglionic cells.

It follows that if on one side this hypothesis confirms the multifactor pathogenesis of POAG, on the other it also imposes the need not only to check the IOP, but also to undertake dietary and therapeutic treatment of the possible alteration of the lipid profile, above all with statins, to slow the impairment of the visual field, which remains the fundamental objective of glaucoma therapy.

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