OPTIC NERVE CHANGES AND OCULAR BLOOD FLOW STUDY WITH GLAUCOMA

An Essay
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Ahmed Ibrahim Aldesouky

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LIST OF ABBREVIATIONS

ACE	***Angiotensin converting enzyme***
AION	***Anterior ischemic optic neuropathy***
AVP	***Arterio venous pulsation***
CAIs	***CARBONIC ANHYDRASE INHIBITORS***
CCBs	***Calcium channel blocker***
C/D	***Cup disc ratio***
CDI	***Color Doppler imaging***
CLBF	***Canon laser blood flowmeter***
CME	***Cystoid macular edema***
C02	***carbon dioxide***
CRA	***Central Retinal Artery***
CRV	***Central Retinal Vein***
DSFS	***Doppler shift frequency spectrum***
EDV	***End diastolic velocity***
FA	***Fluorescein Angiography***
FLO	***Blood flow***
FPA	***Fundus pulsation amplitude***
GBE	***Ginkgo biloba extract***
GON	***Glaucomatous optic neuropathy***
HTG	***High-tension glaucoma***
HRF	
ICG	***Indocyanine green***
IOP	***Intra-Ocular Pressure***
ISA	***Intrinsic sympathomimetic activity***
LDF	***laser Doppler flowmetry***
LDV	***laser Doppler velocimetry***
LGN	***Lateral geniculat nucleus***
LTG	***low tension glaucoma***
MD	***Mean defect***
MMPs	***Metalloproteinases***
NFL	***The nerve fiber layer***
NMDA	***N-Methyl-D-Aspartate***
NO	***Nitric oxide***
NTG	***Normal-tension glaucoma***
O2	***Superoxide anion***
OA	***Ophthalmic artery***
OAG	***Open angel glaucoma***

OBF	***Ocular blood flow***
OCT	***Optical coherence tomography***
OHT	***Ocular hypertension***
ONH	***Optic nerve head***
ONOO	***Peroxynitrite***
OODG	***Oculo oscillo dynamography***
OPA	***Ocular pulse amplitude***
OPP	***Ocular perfusion pressure***
PCAs	***Posterior ciliary arteries***
PP	***Perfusion pressure***
POBF	***Pulsatile ocular blood flow***
PSV	***peak systolic velocity***
RGC	***Retinal ganglion cell***
RI	***Resistivity index***
RNFL	***Retinal Nerve Fiber Layer***
ROI	***Retinal region of interest***
RPE	***Retinal pegment epithelium***
SLDF	***Scanning laser Doppler flowmetry***
SLO	***Scanning laser ophthalmoscopy***
SPCAs	***Short posterior ciliary arteries***
TM	***Trabecular meshwork***
Vel	***Relative speed of the red blood cells in the sampling volume***
Vol	***Relative number of moving red blood cells in the sampling volume***

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INTRODUCTION

INTRODUCTION

Glaucoma is an optic neuropathy characterized by a pathological process called cupping, which is a type of optic atrophy, this produce a nerve fiber layer defect that result in visual field loss . Glaucoma is often, but not always associated with elevated Intraocular Pressure "IOP" **(Stamper et al . 1999).**

Glaucomatous changes in the optic disc (optic nerve head) usually can be detected over time. If the optic cup within the optic disc increases in size over a period of months or years, if notching is observed anywhere around the nerve head rim, and/or if an asymmetry is observed between the optic cups of the two eyes, then that person may be considered to be a "glaucoma suspect." In glaucoma, optic nerve rim atrophy and / or notching, with a corresponding visual field loss, usually will occur in this order:

Optic Nerve defect	Visual Field Loss
1. Inferior defect	Superior Field
2. Superior defect	Inferior Field
3. Temporal defect	Nasal Field
4. Nasal defect	Temporal Field

(Detorakis et al. 2007).

The pathogenesis of nerve fiber defects in glaucoma is still obscure. There is ample evidence that an elevated intraocular pressure (IOP) can induce visual field loss in the affected eye. However, many patients can come with elevated IOP without damage to the optic nerve fibers. Patients with low tension glaucoma (LTG) and thus an IOP between 10 and 20 mmHg develop visual field defects without an elevated IOP, indicating that even an IOP in the normal range is too high for these patients or other factors are involved in visual field loss **(Quigley et al. 1982).**

In pathogenesis of glaucoma, it is recognized that raised IOP can't be the only risk factor leading to glaucomatous damage. In normal tension glaucoma(NTG), vascular factors are considered to play a pathogenic role, so if raised IOP and reduced blood flow are accepted as a major causes of glaucomatous damage to optic nerve, it is expected that elimination of these causes may stop or slow progression of glaucomatous damage **(Harris et al. 1997a).**

Ocular perfusion pressure is the difference between blood pressure and IOP (blood pressure-IOP) thus;a drop in the perfusion pressure can be caused by drop in the blood pressure or rise in the IOP. Blood flow can be linked to perfusion pressure in the following equation:

Blood flow=perfusion pressure/resistance

Thus, a drop of the blood flow can be caused by the drop in perfusion pressure or rise in resistance **(Kaiser et al. 1993).**

Visual field loss, caused by optic nerve damage, is measured by using a "visual field analyzer" or "perimeter," especially by measuring and comparing changes over time. The procedure is known as "perimetry". Most field loss due to glaucoma usually is not even measurable until 25% to 40% of the optic nerve axons have been destroyed **(Galassi et al. 2003).**

New instruments have been developed to measure ocular blood flow including blood flow in the optic nerve head. Several studies indicate that a perfusion instability, rather than a steady reduction of ocular blood flow might contribute to glaucomatous optic neuropathy **(Grieshaer and Flammer. 2007).**

Laser Doppler flowmetry detect circulatory abnormalities in primary open angle glaucoma suspects who did not have any manifest visual field defect . Laser Doppler flowmetry was used to measure optic nerve head blood velocity ,volume and flow at four quadrants in the optic nerve,in the cup and in the foveola **(Piltz-Seymour et al . 2001) .**

In another study, the authors evaluated by means of color doppler imaging, the blood flow of the ophthalmic artery, ciliary arteries and central retinal artery in normal and glaucomatous subjects. In normal subjects they found that flow velocities of all considered vessels progressively declined while sensitivity indices increased with advancing age. In glaucomatous patients there was reduction of the means systolic peak flow velocity of the ophthalmic artery in comparison with normals **(Galassi et al. 1994).**

The nerve image analysis techniques which use scanning laser ophthalmoscopy (SLO), tomography, and laser Doppler flowmetery have improved the ability to study any changes of optic nerve head characters **(Chauhan and Smith. 1997).**

Measurement of ocular blood flow and optic nerve head (ONH) changes might help in early diagnosis of glaucoma and glaucoma suspects. This will be by seeing the relation between the ocular blood flow and the retinal nerve fiber layer which measured by Optical coherence tomography (OCT) which able to identify axonal loss in all four quadrants as will as in each of the twelve 30˚ segments of the disc thus it seems to be a promising instrument in the diagnosis and follow up of neuro-ophthalmic conditions responsible for retinal nerve fiber layer (RNFL) loss. Even if predominantly in the nasal and temporal areas of the optic disc;Thus it will help in screening of glaucoma between people with family history of glaucoma **(Chauhan and Smith . 1997) .**

By measuring the ocular blood flow and its effect on the optic nerve head (ONH) become arole for anew group of anti glaucomatous drugs like neuroprotective drugs in the treatment of glaucoma which has a role in improvement of ocular blood flow of ONH.Many drugs are under investigation for this purpose .Some data from neurologic studies indicate that gingko biloba may be helpful.There are multiple ways in which non pressure related medicine may help treat the ganglion cell death that is glaucoma .It is likely that some types of neuroprotective agent will become an important adjunctive therapy for glaucoma in the future **(piltz Seymour et al .2001) .**

AIM OF THE WORK

To review and discuss methods of studying changes in the optic nerve and blood flow dynamics in glaucoma,thus helping to understand the etiology of this disease , and to improve methods of diagnosis and means of management