Nogal's mechanism of migraine ("MIGRAINE") and primary open-angle glaucoma of "normal" pressure in the light of the "mechanical" and the "vascular" theory of the optic nerve damage.

Piotr Nogal, Ophthalmologist, MEd in Physical Education

"130 years ago von Graefe [von Graefe 1857, 1861] was the first man to describe glaucoma without increased intraocular pressure (...) Having been deeply criticised, von Graefe **departed from** his **theory of glaucoma without increased intraocular pressure** and this **pressure** was once again **recognized as the dominant factor in the pathogenesis of glaucomatous damage and atrophy of the anterior optic nerve.** **However there still remain questions about the aetiology of glaucoma without increased intraocular pressure, if such a disease does actually exist**."

Prof. Alon Harris/US, Glaucomatologist, 2002

"**Clinical observations** undoubtedly indicate the significant **role of abnormalities in blood supply to the optic nerve** in the **process** of its **glaucomatous destruction.** [...] This is also evidenced by **glaucoma** occurring more frequently in persons with **vascular dystonia**, which involves **migraine headaches** **or** a tendency to have **cold hands or cold feet."**

Prof. Maria Hanna Niżankowska, Glaucomatologist, Wrocław/PL -2002

The definition of migraine by P. Nogal ("MIGRAINE"):

M ulti-area
I ndisposition
G enerated
R apidly
A gainst
I ntraocular pressure „relative" increase to
N eurological
E mergency

Multi-area indisposition of the organism generated rapidly against the *"**relative intraocular hypertension** "* [1] **(equal to or higher than the blood pressure in capillary tubes of the choroid !!!)**, leading to an intracranial hypertension, complicated by acute neurological disorders of entire body.

[1] - **term proposed by Piotr Nogal; "PC(VC) IOP ≥ BP in CHOROID" (posterior chamber/vitreous cavity IOP ≥ blood pressure in choroid)**

What is more significant **in open angle glaucoma with "normal" pressure and migraine..?**

...intraocular hypertension (hidden from today's tonometer measurements in a posterior chamber and vitreus) or **arterial hypotension in the choroid?**

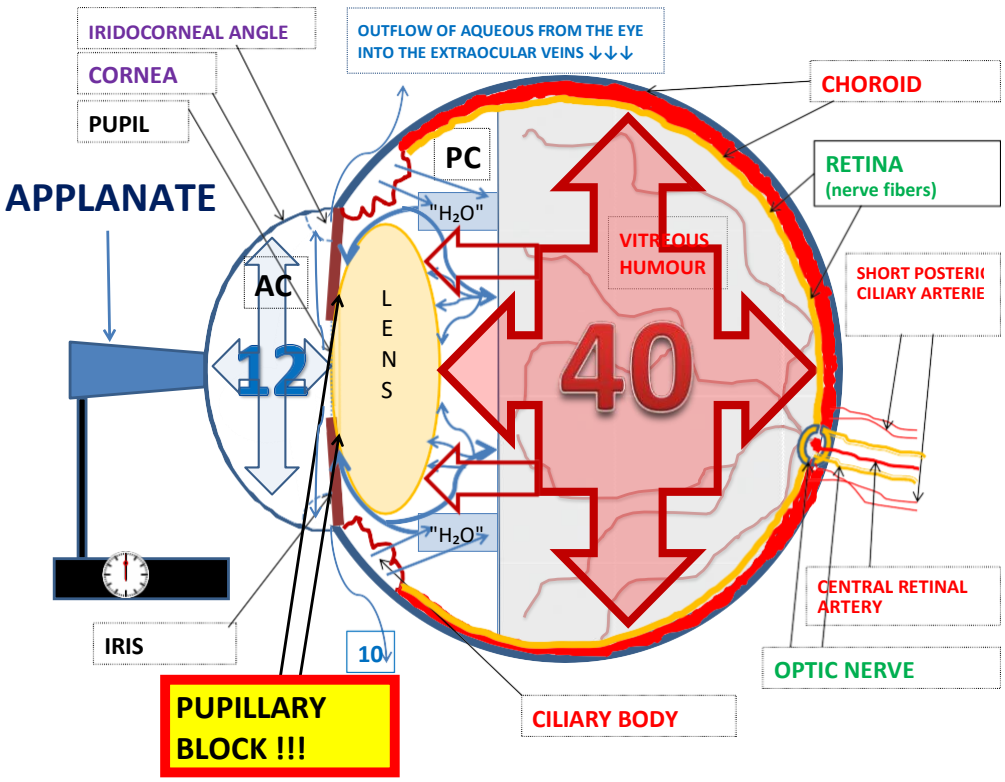
RESEARCHERS OF THE EQUALISATION OF LOW BLOOD PRESSURE IN CHOROID WITH PRESSURE OF THE AQUEOUS HUMOUR AND VITREOUS BODY IN THE EYEBALL:

1936 - **Jan Lauber**, Polish, Warsaw **(world's first in GLAUCOMA)**

2013 - **Piotr Nogal**, Polish, Wroclaw **(world's first in MIGRAINE)**

Why CAN'T we still MEASURE IOP Increase in "normal" pressure glaucoma and migraine...???

SLIDE No. 1: Measurement of intraocular pressure on the cornea using an applanate in case of relatively increased pupillary block; AC-pressure decrease + PC-pressure increase = the result is falsely understated in relation to the increased pressure in the posterior chamber and vitreous cavity (measurement irrelevant to the residual pressure in the eyeball behind the lens and iris!)



Goldmann's applanate - "*golden standard*" ?

Where do we measure **IOP** using it **..**? On the cornea!

In which space of EYE does Goldmann's Applanate *"measure"* intraocular pressure ???

In the anterior chamber of the eye..! ...*NONSENSE ..?!*

Table 1: Quantitative comparison of the presence of anatomical structures of the eyeball in both chambers of the eye, which are involved in primary open-angle glaucoma with "normal" pressure according to the "mechanical" (pressed optic nerv structures) and the "vascular" theory; ischaemic (eyeball vessels) and the ciliary body producing aqueous humour.

ANATOMICAL EYE STRUCTURE	ANTERIOR CHAMBER	POSTERIOR CHAMBER AND VITREOUS HUMOUR CHAMBER
RETINAL NERVE FIBERS	0	1
OPTIC NERVE (HEAD)	0	1
CHOROID	0	1
CENTRAL RETINAL ARTERY	0	1
CILIARY BODY	0	1
RESULT	**0**	**5**

Piotr NOGAL *is the* ***inventor*** *of the world's first* ***non-invasive tonometer of the posterior chamber and/or vitreous humour chamber*** *of the human eye...* ***The idea of creating this tonometer has not been endorsed by the ophthalmologist community yet ..!***

HOW HAVE I DISCOVERED THE MECHANISM OF MIGRAINE

dependent on BP hypotension in the choroid with pupillary block and ↑IOP - in the posterior chamber:

- **comparison of symptoms of superior orbital fissure syndrome with ophthalmoplegic migraine in children (Table 2)**
- **comparison of systemic symptoms of migraine with glaucoma attack (Table 3)**
- **measurements of arterial pressure (hypotension) in >90% of the young "migrainers" (under 40 years of age) treated**
- **observation of equalisation of pressures in the chambers after YAG-iridotomy**
- **clinical trials ("SGT"/89, "MPTT"/90, "AGIS"/98, "EMGT", etc.),**
- **statistical coexistence of migraine with: myopia, MS, Alzheimer, etc…**

"Doctors without anatomy are like moles. They work in the dark and the work of their hands are mounds..."

Prof. Friedrich Tiedemann*; Anatomist and Physiologist (Heidelberg, 1781-1861)*

Table 2: Disorders conditioned by nerves pressed within the superior orbital fissure (in ophthalmoplegic migraine - "neurovascular" conflicts; nerves pressed by ophthalmic veins /sometimes also ophthalmic artery/ widened due to venous hypertension in cavernosus sinus; **according to Piotr Nogal, the mechanism is the same, as that in the Tolosa–Hunt syndrome!!!** [2]).

Symptoms	Superior orbital fissure syndrome	Ophthalmoplegic migraine
Ptosis (n. III)	+	+
Ophthalmoplegia (n. III, n. IV, n. VI)	+	+
Diplopia (n. III, n. IV, n. VI)	+	+
Sensory paralysis of the skin on the forehead and upper eyelid (sensory nerves from n.V1; ophthalmic nerve)	+	+
Mydriasis (n.III; oculomotor root - parasympathetic of the ciliary ganglion)	+	+

[2] - the author's hypothesis after describing the mechanism of migraine

Table 3: comparison of clinical symptoms of a glaucoma attack and migraine seizure

Symptoms	Closed angle glaucoma attack	Migraine seizure
Optical phenomena	Halos around lights, sometimes flashes	Ocular migraine aura (various eye flashes and floaters)
Headache	Strong pain in the eye and head, especially on the ill eye side, initially unilateral	Often starting in the eye, around the orbit, often initially unilateral
Arterial hypertension	+	+
Nausea	+	+
Vomiting	+	+
Disorders of heart rate	Bradycardia, arrhythmia	Heart palpitations, arrhythmia
Photophobia (light sensitivity)	+	+
Phonophobia (sound sensitivity)	+	+
Fainting	+	+
Loss of consciousness	+	+
High IOP (pressure in the eyeball)	+/ not always !!!	(?)
Iridocorneal angle	Closed	(?)

The mechanism of MIGRAINE and "normal pressure" OPEN ANGLE GLAUCOMA (NTG) dependent on the IOP increase in the posterior chamber and accompanying arterial hypotension with secondary blood pressure (BP) decrease in choroid, according to Piotr Nogal

Blood hypotension in the CHOROID !!!; choroid easier pressed by ↑ **pupillary block** → ↑ **intraocular pressure** in the **POSTERIOR CHAMBER** and the **VITREOUS HUMOUR CHAMBER**

Increase in IOP in the **POSTERIOR CHAMBER** and **VITREOUS CAVITY** up to the value ≥ **BP in the choroid** (e.g. in different intensities of the pupillary block)

EQUALISATION OF blood pressure in the choroid and intraocular pressure in PC and VC -START!

REACHING THE LEVEL OF "RELATIVE INTRAOCULAR HYPERTENSION "in the POSTERIOR CHAMBER and the VITREOUS CAVITY OF THE EYE; PC(VC) IOP ≥ BP in CHOROID !!!

START of NOGAL'S GLAUCOMA MECHANISM (UNDERMINING AFTER YEARS OF DISPUTES THE ADHERERS OF BOTH: **the "MECHANICAL" and the "VASCULAR" THEORIES OF GLAUCOMA!** Possible start of **Migraine** according to **"MIGRAINE"** by Piotr Nogal**)**

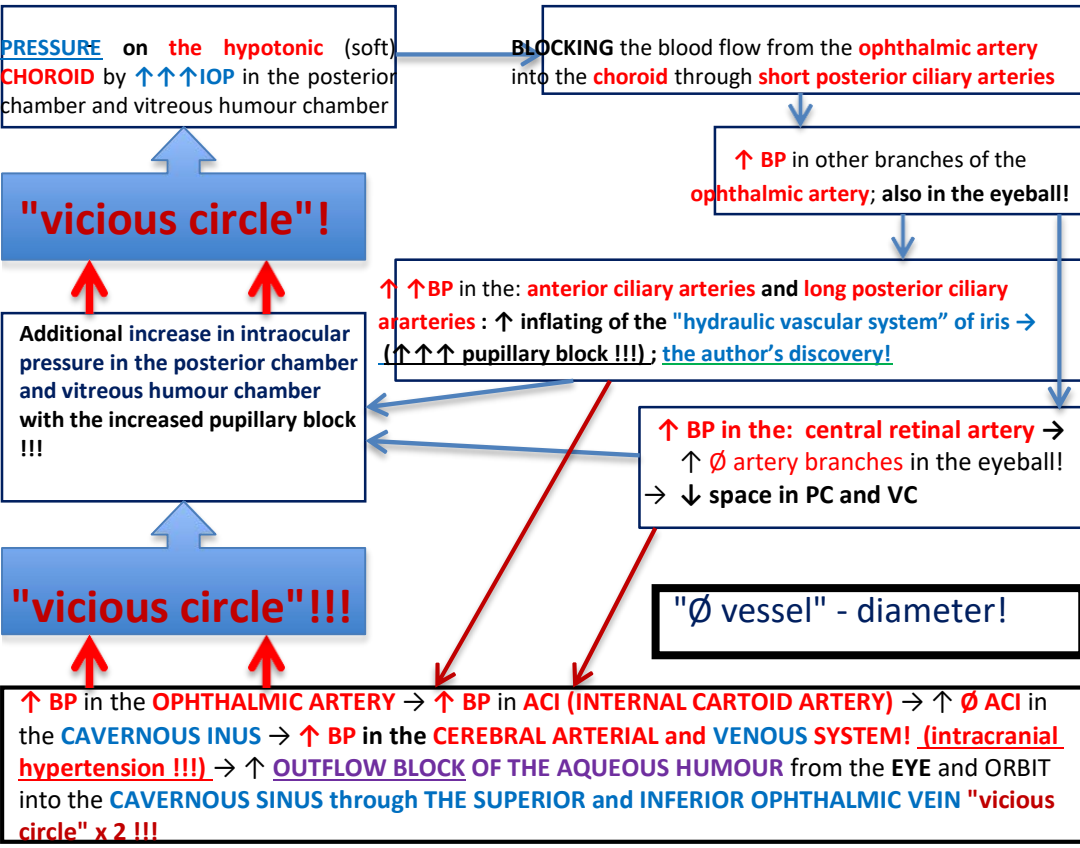


Table 4: Examples of disorders conditioned by the pressure of the arterial and venous vessels, (widened due to blood hypertension), on the adjacent structures in accordance to the mechanism of migraine "MIGRAINE" by Piotr Nogal (hypothetical explanation of an author):

PATHOLOGY	COMPRESSED STRUCTURE	PLACE OF COMPRESSION	COMPRESSING AGENT
TRIGEMINAL NEURALGIA	Gasser's ganglion	Cavernous sinus	↑ Ø ACI ↑ VENOUS BP
AION	Optic nerve	Optic canal	↑ Ø ophthalmic artery
CRVO	Optic nerve, central retinal vein	Intraorbital part of the optic nerve	↑ Ø central retinal artery
Periodic strabismus convergens	Nerve VI	Cavernous sinus, superior orbital fissure	↑ Ø ACI ↑ VENOUS BP
Tolosa-Hunt syndrome	Nerve V1, Nn: III, IV, VI, superior ophthalmic vein	Superior orbital fissure	↑ Ø ophthalmic artery[5] ↑ Ø superior ophthalmic vein

[5] - in approx. 20% of people ophthalmic artery passes through the superior orbital fissure!

Thanks to all my Colleagues, who shared their experiences with me, what allowed me during my continuous training to attract the knowledge necessary to describe the mechanism of "migraine" explaining, inter alia, the pathologies listed in the above table.

Piotr Nogal