

Low intracranial pressure could be a risk factor for developing glaucoma

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Unlike the usual intracranial pressure measuring procedure, which involves the drilling of a small-sized hole into the patient's skull, Prof Ragauskas' invention allows measuring brain pressure non-invasively through the eye using ultrasound. Credit: EPO

An international team of researchers led by Lithuanian scientists provide

additional evidence that intracranial pressure plays an important role in normal-tension glaucoma, which accounts for up to 50 percent of all glaucoma cases. A recent clinical study demonstrates that low intracranial pressure correlates with impaired patient visibility, especially in the nasal zone.

Glaucoma, one of the leading causes of blindness for people over the age of 60, is caused by optic nerve damage. Often, increased pressure inside the eye (called intraocular pressure or IOP) is detected in [glaucoma](#) patients. However, not all people with ocular hypertension develop glaucoma. Moreover, glaucoma can develop in cases of normal IOP. A so-called normal tension glaucoma (NTG) prevalence among patients in the global population ranges from 30 to 90 percent according to different studies.

"Contemporary medicine has methods to treat elevated [eye pressure](#) and to slow or even stop the damage to the optic nerve. However, these methods do not work in the case of normal tension glaucoma. There is a growing awareness among the scientific community, that glaucoma is a condition caused by two pressures—inside the eye and the skull," says professor Arminas Ragauskas from Kaunas University of Technology (KTU), Lithuania.

Ragauskas, the Head of the Health Telematics Science Institute at KTU, is the inventor of the non-invasive [intracranial pressure](#) measurement technology, used in the study described below.

He goes on to explain that anatomically, the optic nerve is connected to the brain, and is surrounded by the cerebrospinal fluid. Both intracranial pressure (ICT), which is pressure inside our skull, measured in the cerebrospinal fluid, and [intraocular pressure](#) (IOP) can affect the condition of the optic nerve. Recently, researchers have focused on the balance between the two pressures, i.e. translaminar pressure difference

(TPD) and its connection to glaucoma development.

A clinical study revealed possible links between brain pressure and glaucoma

80 early-stage normal tension glaucoma (NTG) patients were enrolled in a recent study conducted by researchers from Lithuanian, Israeli and American universities. The subjects were selected from the 300 NTG patients referred to the Eye Clinic at the Lithuanian University of Health Sciences between January and October 2018.

Several measurements including intraocular (IOP), intracranial pressures (ICP), and [visual field](#) perimetry were recorded during the study. The translaminal pressure difference (TPD) was calculated according to the formula $TPD = IOP - ICP$. The visual field was divided into five zones: nasal, temporal, peripheral, central, and paracentral.

The study revealed several statistically significant correlations between intracranial pressure, TPD, and visual field changes. The higher the TPD, the more significant damages to the patient's visual field were registered. The most significant visual field losses occurred in the nasal zone.

"Visual field loss means only one thing—a person is becoming blind. That's why it is so important to understand the causes of this condition and to reverse it. We are all aware of the dire outcome," says Prof Ragauskas.

Researchers conclude that higher TPD could be estimated as a risk factor for the negative development of normal tension glaucoma. As translaminal pressure difference is calculated by subtracting ICP from IOP, the lower the intracranial pressure measure, the higher the TPD. Thus, in normal-tension glaucoma, lowered intracranial pressure is a

possible risk factor.

Technology invented in Lithuania used in the study

"The idea that brain pressure is related to the visual field is not new. Several years ago, we conducted a series of experiments studying the links between visual field and intracranial pressure, using the non-invasive technology developed here, at KTU. In the conferences that followed, I saw how our new idea was met with excitement by the international community of ophthalmologists," says Prof Ragauskas.

Intracranial pressure's correlation with glaucoma opens new avenues for medical professionals to research the reason and possible treatment of this pathology. Also, in recent years, evidence supporting this hypothesis poured in from science groups working around the world. Prof Ragauskas says that his research has, directly and indirectly, contributed to the growing pool of data on the topic.

In the above-described study, the intracranial pressure measurement was obtained via a two-depth Transcranial Doppler (Vittamed UAB, Lithuania) developed by Prof Ragauskas' team at the Kaunas University of Technology labs. Unlike the usual intracranial pressure measuring procedure, which involves the drilling of a small-sized hole into the patient's skull, Prof Ragauskas' invention allows measuring brain pressure non-invasively through the eye using ultrasound. Various industrial applications of the invention were patented in the US and Europe.

"We are not competing with invasive methods, but heading towards an entirely new direction. At the moment, I see that ophthalmology is the field where our technology is needed most, and we are using it for research purposes. However, we are constantly developing our invention and have recently patented a couple of new applications, which might be

used in other contexts where measuring intracranial pressure is crucial. For example, in long-term space missions," says KTU professor Ragauskas.

The findings are published in the journal *Diagnostics*.

More information: Akvile Stoskuvienė et al, The Relationship between Intracranial Pressure and Visual Field Zones in Normal-Tension Glaucoma Patients, *Diagnostics* (2023). [DOI: 10.3390/diagnostics13020174](https://doi.org/10.3390/diagnostics13020174)

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