



How to assess IOP Peak and its Importance in Glaucoma Management

Susanna BN^{1*}, Susanna FN², Susanna CN¹ and Susanna Jr R²

¹Department of Ophthalmology, ABC Foundation School of Medicine, Brazil

²Department of Ophthalmology, University of Sao Paulo School of Medicine, Brazil

***Corresponding author:** Bianca Nicoleta Susanna, MD, Department of Ophthalmology, ABC Foundation School of Medicine, Av. Lauro Gomes, 2000 - Vila Sacadura Cabral, Santo André - SP, Brazil, Tel: 09060-870; Email: binsusanna@gmail.com

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Abstract

Elevated intra-ocular pressure (IOP) and mean IOP are considered the main risk factors for the development and progression of glaucoma. However, some patients still progress with IOP apparently in the target range. This observation has been explained on the basis that other non-IOP dependent risk factors are contributing to the glaucoma pathogenesis in these individuals. An alternative explanation is that progression occurs at least in part due to high IOP peaks not detected during routine eye examinations. Several studies have demonstrated that peak IOP may be a better predictor of glaucoma progression. IOP peak assessment has been used recently to verify if the peak pressure of a given patient is in target range, to evaluate glaucoma suspect risk, the efficacy of hypotensive drugs and to detect early loss of IOP control. These are important aims to be addressed in glaucoma management. Several methods have been described to assess IOP peaks. The costs and labor involved in this make the determination of the 24-hour IOP or contact lens-sensor are difficult if not impossible in all patients. Recently the water drinking test (WDT) has been used as a surrogate marker for outflow reserve to detect IOP instability and to estimate IOP peak pressure. Peak IOP elicited by this test may be an indicator for the likelihood of progression and efficacy of hypotensive drugs the aim this manuscript is to present the importance of detecting IOP peaks in glaucoma management.

Keywords: Glaucoma; Inexpensive; Non-Invasive

Abbreviations: IOP: Intra-Ocular Pressure; WDT: Water Drinking Test.

Since 2001, several studies showed that approximately 15% of glaucoma treated patients become blind during 6-15 years of follow-up [1-5]. It has been suggested that a subset of patients with glaucoma may be particularly susceptible to progression, possibly because of non-IOP-related factors. In other words, it is unknown why 15% of the treated patients became blind in an average time of 7.2 years after diagnose. Elevated intra-ocular pressure (IOP) and mean

IOP are considered the main risk factors for the development and progression of glaucoma. As a result, reduction of IOP to an individualized target is the main treatment strategy. The pressure at which glaucoma occurred, the target IOP and response to treatment are most often determined by a series of single measurements over time during office hours. However, some patients still progress with IOP apparently in the target range. This observation has been explained on the basis that other non-IOP dependent risk factors are contributing to the glaucoma pathogenesis in these individuals [6]. An alternative explanation is that progression

occurs at least in - part due to high IOP peaks not detected during routine eye examinations. Although IOP fluctuation [7-9] is a suggested risk factor for glaucoma progression, recent studies have demonstrated that peak IOP may be a better predictor of glaucoma progression [10-12].

IOP peak assessment has been used recently to verify if the peak pressure of a given patient is in target range, to evaluate glaucoma suspect risk, the efficacy of hypotensive drugs and to detect early loss of IOP control. These are important aims to be addressed in glaucoma management. Several methods have been described to assess IOP peaks. Twenty-four hour IOP monitoring is likely to provide the purest understanding of an individual's IOP control including mean IOP, IOP fluctuation and peak IOP [13,14]. However, with the patient in supine position during sleeping time there are other parameters that may play with the of IOP peak in the pathogenesis of glaucoma damage during this period of time such as CSF pressure, episcleral venous pressure, blood flow rate. The costs and labor involved in this make the determination of the 24-hour IOP course is difficult if not impossible in all patients. Continuous monitoring using Contact Lens Sensor is time and resource-consuming test, may cause corneal damage, be inaccurate based on corneal curvature, thickness and hysteresis and does not allow for estimating the IOP value in millimeters of mercury corresponding to the relative variations of the electrical signal measured.

An inexpensive, non-invasive, time efficient and accurate means of measuring 24-hour IOP is yet to become available. Current methods are time and resource-intensive and are not always feasible in routine practice. It is because of these limitations that the water - drinking test (WDT) is useful in estimate IOP peak that does occur during day-time period. The WDT was originally conceived as a diagnostic test for glaucoma, but was ultimately abandoned for this purpose because of low sensitivity, low specificity and low diagnostic value [15,16]. Recently, this test was revived with a new focus: as a surrogate marker for outflow reserve to detect IOP instability and to estimate IOP peak pressure. Peak IOP elicited by this test may be an indicator for the likelihood of progression [17,18] and efficacy of hypotensive drugs [19-23]. Several studies have shown that peak IOP obtained with this test is strongly correlated and in agreement with the IOP peaks that occur during the day [24-26]. Usually but not always, eyes with higher IOP peaks after water ingestion take to return to baseline IOP levels than eyes with lower IOP peaks, which may reflect the status of the drainage system of the eye.

It has been postulated that a more rapid return to baseline IOP following the WDT may reflect improved outflow [27]. Independent of the mechanism that increases IOP following

the WDT, an intact and active outflow should be associated with rapid IOP recovery whereas impaired outflow is more likely to lead to sustained IOP elevations. Maybe for this reason medically controlled patients with glaucoma have a greater IOP increase with the WDT than patients who have undergone filtration surgeries despite similar baseline IOP [28-31]. The observations that trabeculectomy blunts the WDT response, and therefore IOP peak, may explain why filtering surgeries decrease or halt glaucoma progression compared with medical treatment. The peak IOP elicited by this test is highly reproducible between days and associated with disease severity [8-12] [3,7]. Recently, it has been suggested that the WDT could also be used as a stress test to evaluate retinal ganglion cell function and hence have potential application for risk assessment [12].

How to Perform the Test

Eligible patients [32-38] (i.e., those who are not on fluid restriction because of systemic conditions) liquid-fast for 2-hours before the WDT. The patient's baseline IOP is then measured following which the patient drinks 800ml (27 ounces) of water in 5 min. IOP is measured 15, 30, and 45 minutes after ingestion. The maximum IOP of the three IOP measurements is considered the peak IOP.

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