

# Diagnostic Value of Water Drinking Test in Primary Open Angle Glaucoma

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## ABSTRACT

**Background:** Primary open angle glaucoma (POAG) is neurodegenerative disease of the optic nerve that presents to the practitioner at various stages of continuum characterized by accelerated ganglion cell death, subsequent axonal loss and optic nerve damage, and eventual visual loss.

**Aims:** To determine diagnostic value of water drinking test in primary open angle glaucoma.

**Material and methods:** This clinical trial was carried out in Department of Ophthalmology, CMH Malir Karachi between 1<sup>st</sup> July 2008 to 30<sup>th</sup> June 2010. A total of 100 patients were selected for this study. Fifty cases of POAG, raised IOP, open angles on gonioscopy. The findings were compared with 50 normal controls having IOP <20 mmHg, no visual fields (VF) defects, healthy discs, open angles on gonioscopy and no ocular pathology. POAG patients with glaucomatous visual fields defects, glaucomatous disc changes, raised IOP, open angles on gonioscopy, and normal controls with IOP <20 mmHg, included in the study. The patient was asked to drink 1 L of water in less than 5 minutes. IOP measurement was repeated three times with 15-minute intervals. A rise in IOP of 6 or more than 6mmHg was considered significant and test was declared positive.

**Results:** The mean age of the patients in case group was 61.5±10.1 and in control group was 52.4±10.1 years. In case group, mean baseline IOP with medication was 15.0±5.0 mmHg, mean WDT IOP with medication was 19.4±7.9 mmHg, mean Baseline IOP without medication was 19.6±5.6 mmHg, mean WDT IOP without medication was 23.5±5.7 mmHg, mean IOP after 15 minutes of WDT was 26.4±6.9 mmHg and IOP after 30 minutes of WDT was 27.3±6.9 mmHg. In control group, the mean baseline IOP without medication was 13.8±1.8 mmHg, mean WDT IOP without medication was 15.7±2.3 mmHg, mean IOP after 15 minutes of WDT was 14.2±1.7 mmHg and mean IOP after 30 minutes of WDT was 15.9±2.3 mmHg. The significant difference was noted between the two groups.

**Conclusion:** It is concluded from this study that in case group, there was significant difference between baseline IOP and IOP after 30 minutes of WDT and in control group there was not significant difference between baseline IOP and IOP after 30 minutes of WDT.

**Key words:** Primary open angle glaucoma, diagnostic value, water drinking test, intraocular pressure.

## INTRODUCTION

Glaucoma is a potentially blinding disease. Primary open angle glaucoma (POAG) was defined as having a history of intra ocular pressure (IOP) higher than 21 mmHg in at least one eye before the treatment, presence of glaucomatous visual field damage and glaucomatous optic nerve lesion, open angles with normal findings on gonioscopy, and no history of any other ocular disease that can cause an increase in IOP. Water drinking test (WDT) is one of the provocative tests for glaucoma. Water drinking test has been the most widely used, and has had the most standard technique determined. It is relatively easy and safe to perform, causes the patient little distress and given results that are fairly simply interpreted. Furthermore, when the test is performed properly, the majority of patients with elevated intraocular pressure react positively and those with normal intraocular pressure react negatively<sup>1</sup>.

Glaucoma treatment is based mainly on IOP reduction. However, even in situations in which pressure levels are considered within adequate limits under clinical therapy. Some patients continue to have progressive glaucoma.<sup>2,3,4,5</sup> One possible explanation was described by Drance<sup>6</sup>, who showed that almost

one third of patients with single IOP measurements taken during doctor's office hours has pressure peaks detected only during a 24 hour pressure curve. According to Zeimer et al<sup>7</sup>, 29% of patients with progressive loss of visual field had IOP peaks. Cartwright and Anderson<sup>8</sup>, in one retrospective analysis of 14 cases of normal tension glaucoma with asymmetric damage showed that the eyes with worse glaucomatous damage presented higher levels of IOP. These data emphasize the need of IOP variability assessment in patients with glaucoma.

The WDT has been proposed initially by Schmidt<sup>9</sup> as a tool for the diagnosis of glaucoma. However, a poor correlation with the disease and its low prognostic value have been demonstrated.<sup>10,11</sup> More recently, Malerbi et al<sup>12</sup> demonstrated the usefulness of this test in the assessment of patients with POAG whose IOPs were equal to or less than the established target IOP during single measurements at the ophthalmologist's office.

## MATERIAL AND METHODS

This clinical trial was carried out in Department of Ophthalmology, CMH Malir Karachi between 1<sup>st</sup> July 2008 to 30<sup>th</sup> June 2010. A total of 100 patients were selected for this study. Fifty cases of POAG, raised IOP, open angles on gonioscopy. The findings were compared with 50 normal controls having IOP <20 mmHg, no visual fields (VF) defects, healthy discs, open angles on gonioscopy and no ocular pathology.

POAG patients with glaucomatous visual fields defects, glaucomatous disc changes, raised IOP and normal controls with IOP<20 mmHg, no VF defects, healthy discs were included in the study. The patients of glaucoma other than POAG, IOP more than 20mmHg but with no disc were excluded from the study. No fluid ingestion was allowed 3 hours before the WDT. A basal IOP measurement was taken with the Goldmann applanation tonometer. The patient was asked to drink 1 L of water in less than 5 minutes. IOP measurement was repeated three times with 15-minute intervals. A rise in IOP of 6mmHg or more was considered significant and test was declared positive. The collected data was entered into SPSS version 12 and analyzed. The quantitative variables like age and IOP were presented as mean and standard deviation. The qualitative variables like gender and duration of disease were presented as frequency and percentages.

## RESULTS

The mean age of the patients in case group was 61.5±10.1 and in control group was 52.4±10.1 years. In case group, mean baseline IOP with medication was 15.0±5.0 mmHg, mean WDT IOP with medication was 19.4±7.9 mmHg, mean Baseline IOP without medication was 19.6±5.6 mmHg, mean WDT IOP without medication was 23.5±5.7 mmHg, mean IOP after 15 minutes of WDT was 26.4±6.9 mmHg and IOP after 30 minutes of WDT was 27.3±6.9 mmHg. In control group, the mean baseline IOP without medication was 13.8±1.8 mmHg, mean WDT IOP without medication was 15.7±2.3 mmHg, mean IOP after 15 minutes of WDT was 14.2±1.7 mmHg and mean IOP after 30 minutes of WDT was 15.9±2.3 mmHg. In case group, there was significant difference between baseline IOP and IOP after 30 minutes of WDT and in control group there was no significant difference between baseline IOP and IOP after 30 minutes of WDT. The significant difference was noted between the two groups (Table 1).

Table 1: Distribution of patients by mean IOP

Intraocular Pressure	Case group (n=50)	Control group (n=50)	P value
Baseline IOP with medication	15.0±5.0	---	--
WDT IOP with medication	19.4±7.9	---	--
Baseline IOP without medication	19.6±5.6	13.8±1.8	0.01
WDT IOP without medication	23.5±5.7	15.7±2.3	0.001
IOP after 15 minutes of WDT	26.4±6.9	14.2±1.7	0.001

IOP after 30 minutes of WDT	27.3±6.9	15.9±2.3	0.001
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## DISCUSSION

Intraocular pressure is the main risk factor for the development and progression of glaucoma. The diurnal tension curve (DTC) is currently the most valid diagnostic method to assess the IOP behavior throughout the day. Attempts have been made to develop an alternative, more user-friendly test, capable of providing valuable information regarding IOP peak and fluctuation. A test designed to substitute the DTC in clinical practice should not only duplicate the IOP peak and IOP changes observed at a DTC, but also be reproducible, regardless of the time when it is performed.<sup>13</sup> The WDT is intended to represent an option for the detection of pressure spikes in glaucomatous patients who apparently have controlled IOPs. It is a test that can be easily performed and repeated several times without major inconveniences.<sup>13</sup> Initially, some studies suggested that there was a good correspondence between IOP peaks obtained in the WDT and the maximum DTC values. Helal Jr<sup>14</sup> verified a similarity between mean maximum IOP levels measured in the DTC and mean IOP peaks obtained with the WDT in 11 glaucoma suspects, indicating that this test could substitute the DTC. However, this study compared mean IOP values, masking the differences in each individual's measurements. In fact, in the present study, we also demonstrated that mean IOP peaks and mean IOP changes were not significantly different when we compared results of WDTs performed at different times of the day.

Miller<sup>15</sup> compared the peak IOPs obtained after the WDT and the maximum IOPs measured in a DTC and concluded that there was significant relationship between them. However, the analysis of the individual results allows us to disclose discrepancies of up to 16 mmHg between the tests. In the present study the mean baseline IOP in case group was 19.6±5.6 mmHg and in control group mean baseline IOP was 13.8±1.8 mmHg. As compared with the study of Medina et al<sup>16</sup> in case group mean IOP at baseline was 20.7±4.2 mmHg and in control group was 12.9±3.6 mmHg, which is comparable with our study. Medina et al<sup>16</sup> reported that in case group after water drinking test mean IOP was 25.1±5.6 mmHg and in control group was 16.1±4.4 mmHg. Whereas in the present study, after water drinking test mean IOP was 23.5±5.7 mmHg, and in control group was after WDT mean IOP was 15.7±2.3 mmHg which is comparable with our study.

In the present study mean IOP after 15 minutes of WDT was 26.4±6.9 mmHg and in control group was 14.2±1.7 mmHg. As compared with the study of Medina et al<sup>16</sup> in case group after 15 minutes of water drinking test mean IOP was 29.5±4.2 mmHg and in control group was 19.3±2.4 mmHg, which is comparable with our study. Medina et al<sup>16</sup> also reported that in case group after 30 minutes of water drinking test mean IOP was 29.7±4.1 mmHg and in control group was 18.3±2.2 mmHg. In our study mean IOP after 30 minutes of WDT was 27.3±6.9 mmHg and in control group was 15.9±2.3 mmHg which is comparable with the present study.

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