WATER DRINKING TEST: AN OUTDATED MODALITY OR STILL A USEFUL TEST WHILE MANAGING PATIENTS OF GLAUCOMA

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ABSTRACT

Objective: To compare the mean rise in intraocular pressure in patients with primary open angle glaucoma following water drinking test, with healthy individuals.

Study Design: Quasé-experimental study.

Place and Duration of Study: Armed Forces Institute of Ophthalmology Rawalpindi from September 2011 to March 2012.

Patients and Methods: One hundred and twenty eyes that fulfilled the laid down criteria were enrolled and the intra-ocular pressure was measured before and 45 minutes after the water drinking test (WDT). Difference in IOP before and after WDT was calculated in both cases (of glaucoma) and controls and mean difference in IOP was compared in both the groups. A difference of 6 mm Hg before and after water drinking test was considered significant.

Results: After WDT, IOP was increased significantly in cases as well as the controls but the increase in IOP was significantly higher in cases than the controls.

Conclusion: It is concluded from this study that the comparison of difference between mean baseline intra-ocular pressure and mean intra-ocular pressure after 45 minutes of water drinking test between cases and controls was statistically significant.

Keywords: Glaucoma, Intraocular pressure, Tonometry, Water drinking.

INTRODUCTION

Glaucoma is a potentially blinding disease which is considered a challenge by the ophthalmologist, both from diagnostic and treatment point of view. It is a neurodegenerative process, commonly affecting individuals more than 40 years of age[1]. It is usually bilateral but may be asymmetrical[2]. Glaucoma accounts for 8.1% of all ophthalmology related admissions in Pakistan[3]. Intra ocular pressure (IOP) continues to fluctuate during the day[4] and this occurs in healthy individuals as well as patients having glaucoma[5]. This fluctuation may not only cause the physician to miss some of the patients having raised IOP but also is responsible to produce progression in disc damage in glaucoma patients having apparently normal IOP in office hours[6,7]. The fluctuation in IOP is determined by the balance between the aqueous inflow and outflow facility. The best method to evaluate IOP fluctuation is using a 24-hour daily tension curve[8]. However this is very cumbersome and not practically possible. It has been postulated that fluctuations in IOP may be produced in clinical settings by osmotic variations caused by water ingestion using Water Drinking Test (WDT) as a provocative test[9,10]. WDT is thus used by some centers in developed countries as an additional tool in confirming diagnosis of glaucoma[11,12]. Studies show that WDT can cause fluctuations in IOP in patients suffering from Primary Open-Angle Glaucoma (POAG) when compared with normal individuals[12]. The rationale of this study was to evaluate the fluctuations in IOP in Pakistani patients with POAG after performing WDT, so that this simple test can be used by ophthalmologists as an additional tool in diagnosing and monitoring glaucoma as it is an easy, reliable, simple and cheap method to do so.

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PATIENTS AND METHODS

This quasé-experimental study was carried out at Armed Forces Institute of Ophthalmology from September 2011 to March 2012. Diagnosed cases of POAG who reported to outpatient department of AFIO were included in the study. Controls were taken as the normal healthy individuals, accompanying other patients , who were aged more than 40 years and had no ocular or systemic disease. A total of 120 eyes of 62 patients having POAG and 120 eyes of 60 normal controls were included in this study. Exclusion criteria included all the patients of glaucoma other than POAG, patients with history of glaucoma filteration surgery / laser trabeculoplasty or any other ocular pathology. Data was collected by taking history and examination of cases and controls. Written informed consent was taken from all individuals being considered in the study. No fluid ingestion was allowed for three hours prior to the test. Baseline IOP was recorded by Goldmann applanation tonometry. Patient was asked to drink 1 litre of safe, drinking water in a comfortable environment. IOP was recorded by the author at baseline and at 45 minutes interval after drinking water. Data analysis was done using SPSS version 20 . Analysis of variables like age, and comparison of IOP before / after the WDT in the two groups was done using the paired sample T test, whereas the gender was compared using chi square test. Mann – Whitney test was applied for comparing the mean IOP difference occuring in each group before and after WDT. A *p* – value <0.05 was considered significant.

RESULTS

Sixty two patients having POAG were studied and 120 eyes in these patients met the inclusion criteria. A total of 120 eyes of sixty normal controls were also included in our study for comparison. The mean age of the cases was 66.22 ± 8.443 years and of controls was 65.13 ± 7.802 years. In case group, 41(68.3%) patients were male and 38 (31.7%) were female. In control group, 49 (81.7%) were male and 22(18.3%) females as depicted in fig-1. Both the groups were comparable with respect to age (p=0.118) but there was significant difference in gender (p=0.017).

In the cases, baseline IOP ranged from 7-28 mmHg whereas the mean IOP at baseline was 16.09 ± 4.613 mm Hg. In the controls, at baseline IOP ranged from 7-23 mmHg and the mean IOP was 14.34 ± 3.965 mm Hg. Baseline IOP in glaucoma patients was more than normal than in controls (p<0.001). The IOP after 45 minutes of WDT ranged from 10-31 mm Hg whereas the mean IOP was 19.63 ± 4.705mm Hg in the cases. In the controls, the IOP after 45 minutes of WDT ranged from 8-26 mm Hg whereas mean IOP was17.06 ± 4.078 mm Hg. There was significant increase in IOP after WDT in cases (p=0.001) and controls (p=0.001).

In the cases, mean difference between baseline IOP and IOP after 45 minutes of WDT was found to be 3.53 ± 1.263 mm Hg. No change in IOP was observed in only one of the 120 eyes and the maximum difference of IOP that was observed was 6 mm Hg occurring in 4 (3.3%) eyes. A difference of 4 mm Hg was seen in 38 (31.7%) of the eyes. Mean difference between baseline IOP and IOP after 45 minutes of WDT in the controls was found to be 2.72 ± 1.862 mm Hg .There was no change in IOP in 12 (10%) of the 120 eyes and the maximum difference of IOP that was observed was 8 mm Hg occurring in only one eye. A difference of 2 mm Hg was seen in 29 (24.2%) of the eyes (table-1).

Table-1: IOP of cases and controls before and after FDT.

Group	Mean ±SD IOP at baseline (mm Hg)	Mean ± SD IOP after 45 minutes of WDT (mm Hg)	Mean±SD difference of IOP (mm Hg)
Cases (n=120 eyes)	16.09 ± 4.613	19.63 ± 4.705	3.53 ± 1.263
Controls (n=120 eyes)	14.34 ± 3.965	17.06 ± 4.078	2.72 ± 1.862
p value	0.002	0.024	0.001

Change in IOP was significantly higher in cases than the controls (p=0.001). Thus this test can be used as an indicator of fluctuations occuring in IOP in glaucoma patients and although it may not be independently used as a diagnostic test, it may help as an additional screening tool in suspects fulfiling various other criteria for diagnosis of glaucoma.

DISCUSSION

Glaucoma is considered as a silent and dangerous condition which can damage the optic nerve head without causing many symptoms. It can be caught at an early stage only if a high index of suspicion is kept and screening of individuals is done after 40 years of age. However, diagnosing glaucoma, especially at an early stage is not a very simple job. Many factors are to be considered before making the final diagnosis, as this decision will have a life-long impact on the patient; psychologically, monetarily and physically. Furthermore, it has been seen that glaucomatous changes continue to progress even when patient is on treatment[7]. As is known to the clinicians, the most important and modifiable risk factor for the development and progression of this disease is IOP[13,14]. Currently the most valid diagnostic method to assess the IOP behavior throughout the day is the diurnal tension curve (DTC)[15]. This however is a very cumbersome procedure. The need of the day is an alternative, more practical test, capable of substituting the DTC in clinical practice. It has to be simpler[16], reproducible and comparable to changes observed at a DTC[17,18].

WDT is intended to represent an option for the detection of the spikes in IOP occurring during the day, responsible to produce progression of the glaucomatous damage to the disc. Initially in 1928, it was proposed as a method to diagnose glaucoma by Schmidt but was found to be neither specific nor sensitive[19,20]. In 1998 Helal Jr[21] studied a group of 11 glaucoma suspects and verified similarity between mean maximum IOP levels measured in the DTC and mean IOP peaks obtained with the WDT. Miller also compared the peak IOPs obtained after the WDT with DTC and concluded that there was significant relationship between them[18]. In 2008, Kumar studied 25 patients and concluded that peak IOP measured during DTC showed strong correlation with peak IOP during WDT[22].

In our case group, mean baseline IOP was 16.09 ± 4.613 mmHg. In the study conducted in Pakistan by Naqvi et al[23] it was 19.6 ± 5.6 mmHg and in Medina et al[11] case group mean IOP at baseline was 20.7 ± 4.2 mmHg. In another study conducted by Danesh in 2008 it was 11.1 ± 1.8 mmHg[16] Susanna Jr[12] carried out a retrospective analysis of 76 eyes and the mean basal IOPs were 13.9 +/- 3.3 mm Hg. This shows a spectrum of different mean baseline IOPs in glaucoma patients of different studies.

In the control group of our study, the mean

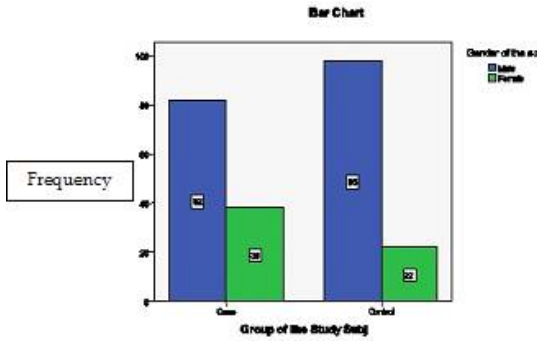

Figure-1: Gender distribution of cases and controls.

baseline IOP was 14.34 ± 3.965 mmHg. In the study of Naqvi SAH[23], the mean baseline IOP in control group was 13.8 ± 1.8 mmHg as compared with the study of Medina et al[11] it was 12.9 ± 3.6 mmHg, both of which were comparable with our study.

We measured IOP after an interval of 45 minutes of performing WDT and mean IOP was 19.63 ± 4.705mm Hg in the case group. In the study conducted by Kerr, Danesh-Meyer in 2010[10], mean IOP after 45 minutes of WDT was 15.3 ± 2.4 mm Hg. In our control group, mean IOP after 45 minutes of WDT was 17.06 ± 4.078 mmHg.

In our study the mean difference in baseline IOP and IOP after 45 minutes of WDT was 3.53 ± 1.263 mmHg in the cases. In a study conducted by Madina et al[11] it was 3.33 ± 1.354

mm Hg. The study conducted by Susanna Jr[12] calculated mean IOP peaks in each of the eyes of patients having POAG and found them to be 3.6 ± 1.8 and 4.4 ± 2.2 mm Hg. All of these results are comparable to our study.

In our control group the difference between baseline IOP and IOP after 45 minutes of WDT was 2.72±1.862 and in Madina et al study it was 3.33 ± 1.75 mm Hg[11].

These results show that mean of baseline IOP, IOP after 45 minutes as well as the mean difference in IOP after performing WDT was much higher in patients having POAG as compared to the controls.

CONCLUSION

This test could have the potential to be used to measure IOP fluctuations in patients who continue to have progression of glaucoma inspite of readings within normal range, in a single office reading, thus avoiding the need of diurnal IOP monitoring. It can also be used as an additional screening tool in glaucoma suspects in setups where there is limited availability of modern diagnostic facilities like automated visual field analyzer, pachymetry and OCT for nerve fibre layer defects.

CONFLICT OF INTEREST

The authors of this study reported no conflict of interest.

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