ORIGINAL ARTICLE

Study of Accuracy of Intraocular Pressure measured by non-contact (air puff) Tonometer confirmed by Goldmann Applanation Tonometer

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ABSTRACT

Aim: To determine the frequency of accuracy of intraocular pressure measured by non-contact (air puff) tonometer confirmed by Goldmann Applanation Tonometer

Methods: This cross sectional study was conduct at Department of Ophthalmology, King Fahad Armed Forces Hospital, Jeddah from September 2015 to March 2016. Total 240 patients were enrolled. Patients having age 10 years to 70 years both male and female coming to eye OPD for refraction, routine checkup of intraocular pressure of already diagnosed cases of glaucoma, suspected glaucoma patients and patients coming for cataract surgery were included in the study.

Results: Mean age of the cases was 43.844±15.434 years and mean IOPs were 18.92±8.852 mmHg and 21.463±9.456 with Goldmann Applanation Tonometer and air-puff tonometer respectively. Ranges of measurements were 10 to 54mmHg with Goldmann Applanation Tonometer and 11 to 58 mmHg with air-puff tonometer

Conclusions: Air puff tonometer is quick and non contact method to measure intraocular pressure and is useful largely for screening purposes but the measurements should be confirmed with Goldmann Applanation Tonometer for accurate labeling of intraocular pressure.

Keywords: Glaucoma, Tonometry, Air puff tonometer, Goldmann Applanation Tonometer

INTRODUCTION

The eyes are complex sense organs that are concerned with the important visual functions within its protective casing, each eye has a longer of receptors , a lens system that focuses light on these receptor to the brain. For maintaining the optimal shape and proper functioning aqueous humor in circulation is important. Aqueous humor, a clear liquid that nourishes the cornea and lens, is produced in the ciliary body. Flows through the pupil and fills the anterior chamber of the eye. It is normally reabsorbed through a network of trabeculae into the canal of Schlemn[1]. From here it passes to epischeral veins[1].

The intraocular pressure within the eye normally varies from 10-20mmHg[2]. The intraocular pressure above the normal range is most likely to cause optic nerve damage, the condition is called glaucoma. Although glaucoma can still occur at normal intraocular pressure called as normal tension glaucoma but the mainstay of treatment lies on exact measurement of intraocular pressure and lowering it with the help of various treatment options. Glaucoma is the third major cause of blindness (7%) in people age 30 years and above in Pakistan[3].

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Intraocular pressure is the most important and manageable risk factor for glaucoma treatment.[4-5]The intraocular pressure is the only risk factor that is modifiable. Although intraocular pressure is useful in gauging the effectiveness of therapy, but it does not tell much about the progress of the disease. Thus the ophthalmologist relies heavily on the appearance of the optic nerve head and the results visual field testing to tell him if the patient`s vision is getting worse or not.

Measurement of intraocular pressure is therefore routine procedure in ophthalmic examination. Different methods have been described to measure intraocular pressure. Air puff tonometry is one of the method used to measure intraocular pressure that has the advantage of non contact technique therefore no chance of transmitting cross infection that is in Goldmann Applanation tonometry. Air puff tonometry can be performed by non ophthalmologist in less time than Goldmann Applanation tonometry. Various studies have shown the accuracy and reliability of air puff tonometers to assess intraocular pressure. Some suggest its accuracy in normal range of intraocular pressure, other says it is accurate at high intraocular pressure.

MATERIAL AND METHODS

This cross sectional study was conducted in the Department of Ophthalmology, King Fahad Armed

Forces Hospital, Jeddah from September 2015 to March 2016. Total 240 patients were enrolled by using Non probability consecutive sampling technique. Permission was taken from institutional review board and written consent was taken from every patient included in the study.

Patients having age 10 years to 70 years both male and female coming to eye OPD for refraction, routine checkup of intraocular pressure of already diagnosed cases of glaucoma, suspected glaucoma patients and patients coming for cataract surgery were included in the study after complete ocular examination. Patients with corneal Opacity or disfigured cornea, corneal ulceration or inflammation, conjunctivitis or ocular infection, corneal dystrophy, corneal degeneration, keratoconus, pterygium, history of any ocular surgery, patients in whom IOP measuring was difficult like blephorosphasm, phthisis bulbi and un co-operative patients were excluded from the study.

All the selected patients underwent complete ocular examination including history, slit lamp examination, visual acuity and auto refraction.

Intraocular pressure was taken first with automated air puff and then IOP of the same eye is taken with Goldmann Applanation Tonometer. Average of three readings with both the air puff and Goldmann Applanation Tonometer were taken. Accuracy was deduced as positive if IOP measured by air puff tonometer differ±2mmHg from Goldmann Applanation Tonometer reading. Bias was controlled by applying the standardized measurement techniques while doing Goldmann Applanation and air puff tonometery and by masking the result of air puff tonometer to the consultant doing Goldmann tonometery. Data was collected on specially designed structure approved Performa. All the data was entered in SPSS version 18 and analyzed. Mean and standard deviation was calculated for numerical variables and frequencies were calculated for categorical variables.

RESULTS

Total 240 cases were selected for this study. Mean age of the cases was 43.844±15.434 years and mean IOPs were 18.92±8.852mmHg and 21.463±9.456 with Goldmann Applanation Tonometer air-puff tonometer respectively. Ranges of measurements were 10 to 54 mmHg with Goldmann Applanation Tonometer and 11 to 58 mmHg with air-puff tonometer (Table 1 & 2). Male cases were 132 (55%) and female cases were 108(45%) (Fig. 1). The overall frequency of accuracy of air-puff tonometer was noted in 125(52%) cases. The frequency of accuracy of air-puff tonometer within limit of ±2mmHg from Goldmann Applanation Tonometer was stratified over different ranges of intraocular pressure as 10-20 mmHg, 21-30 mmHg, 31-40mmHg, 41-50mmHg and 51-60mmHg. It was most accurate 55.21% in normal range of intraocular pressure i.e., 10 to 20mmHg and accuracy decreased with increasing range of intraocular pressure. The accuracy was only 20% at 51 to 60mmHg range of intraocular pressure (Table 3)

Fig. 1: Gender distribution of cases

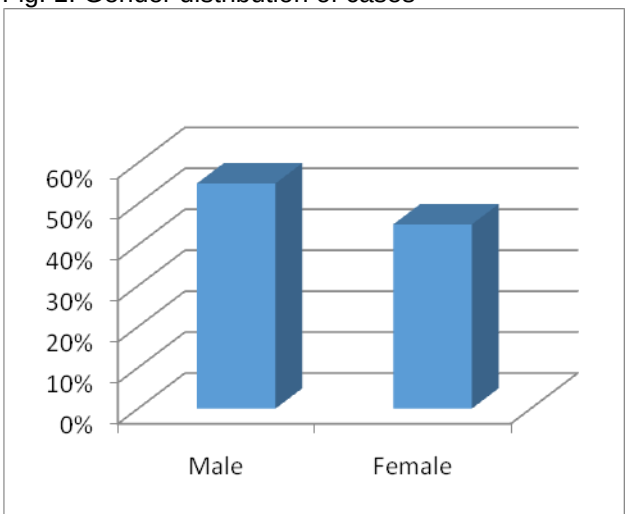

Table 1: Intraocular pressure with Goldmann Applanation Tonometer

Total	240
Minimum	10mmHg
Maximum	54mmHg
Mean	18.92mmHg
SD	8.852mmHg

Table 2: Intraocular pressure with air puff tonometer

Total	240
Minimum	11mmHg
Maximum	58mmHg
Mean	21.463mmHg
SD	9.456mmHg

Table 3: Accuracy of Air puff tonometer in stratified ranges of IOP

Range of IOP(mmHg)	Accuracy		Total
	Positive	Negative	
10-20	90(55.21%)	73(44.79%)	163(67.92%)
21-30	18(52.94%)	16(47.05%)	34(14.17%)
31-40	11(47.83%)	12(52.17%)	23(9.58%)
41-50	5(33.3%)	10(66.67%)	15(6.25%)
51-60	1(20%)	4(80%)	5(2.08%)
Total	125(52%)	115(48%)	240

DISCUSSION

Goldmann Applanation Tonometer and Non Contact Air Puff Tonometer are usually commonly used in day-to-day ophthalmic clinic practice. Usually it is thought that GAT is superior and more reliable. The

GAT is currently the most widely used instrument for measuring IOP, and is considered the 'gold standard[8-9].

However, the GAT has two disadvantages. First, the instrument probe must come into direct contact with the cornea, which can increase the risk of infection. Second, use of the GAT requires a local anaesthetic, and some patients, especially children, are unwilling or unable to tolerate drug instillation. With these factors in mind, several non-contact tonometers have been developed to facilitate measurement of IOP during vision screening. Several comparative studies have demonstrated the reliability and accuracy of IOP measurements obtained with non-contact tonometers (both desktop and portable) and their correlation with measurements obtained with the GAT in subjects with and without glaucoma[10].

In present study mean age of the cases was 43.844±15.434 years and mean IOPs were 18.92±8.852mmHg and 21.463±9.456 with Goldmann Applanation Tonometer air-puff tonometer respectively.

In one study by Ahmad et al,[2] the mean age of the cases was 42.965 years with range of age was 10 years to maximum 72 years which is comparable with our study. In same study the mean IOPs were 19.692±9.952 mm Hg with Goldmann Applanation Tonometer and 22.562±10.355 with air-puff tonometer which are also comparable with our study. Mahsud et al[11] also reported that IOP measured with APT ranged from 10 mmHg to 47mmHg with a mean of 18.17+8.25 mmHg, while IOP recorded with GAT ranged from 10 mmHg to 41mmHg with a mean of 15.59+7.75 mmHg. In present study the overall frequency of accuracy of air-puff tonometer was noted in 52% cases.

Ahmed et al[2] reported the overall frequency of accuracy of air puff tonometer as 49.70% which is comparable with our findings.

The frequency of accuracy of air-puff tonometer within limit of ±2mmHg from Goldmann Applanation Tonometer was stratified over different ranges of intraocular pressure as 10-20mmHg, 21-30mmHg, 31-40 mmHg, 41-50mmHg and 51-60 mmHg. It was most accurate 55.21% in normal range of intraocular pressure i.e., 10 to 20 mmHg and accuracy decreased with increasing range of intraocular pressure. The accuracy was only 20 % at 51 to 60 mmHg range of intraocular pressure.

In one study the number of eyes with IOP ranging from 10-20mmHg were 147(73.5%) with APT. In same study the IOP measured with APT ranged from 10 mmHg to 47mmHg with a mean of 18.17+8.25mmHg, while IOP recorded with GAT ranged from 10mmHg to 41mmHg with a mean of 15.59+7.75 mmHg[11].

CONCLUSION

Air puff tonometer is quick, a non-contact method to measure intraocular pressure and is useful for screening purposes but the measurements should be confirmed with Goldmann Applanation Tonometer for accurate labeling of intraocular pressure.

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