

Comparative Study of Intraocular Pressure (IP) in Bangladeshi Individuals by Contact and Non Contact Technique

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Abstract:

Background: Intraocular pressure (IOP) is one of the most important parameters in the diagnosis and treatment of glaucoma¹. Glaucoma has been established as the second leading cause of blindness. The treatment of glaucoma focuses mainly on lowering intraocular pressure (IOP). The target IOP is often set to a level 20% to 30% of IOP reduction, and consequent large IOP reduction beyond 30% or even 40% in cases of advanced glaucoma². The different methods of tonometry are: Goldman Applanation tonometry, Noncontact (air-puff) tonometry, Perkins tonometry, Tonopen tonometry, Transpalpebral tonometry. **Objective:** To determine the frequency of accuracy of intraocular pressure (IOP) measured by non-contact (air puff) tonometer compared with Goldmann applanation tonometer. **Methods:** This was a non-interventional, cross sectional study conducted at a tertiary care centre of Dhaka, Bangladesh. consecutive subjects attending the BSMMU eye OPD were included in the study. IOP was measured by non-contact (air puff) tonometer and a slit lamp mounted GAT in all the subjects. The study samples were selected by convenience sampling who presented for check-up in the Eye Department of community ophthalmology, Bangabandhu Sheikh Mujib Medical University, Dhaka. Bangladesh. Results: A total of 120 eyes in 60 patients were studied. The mean age of the patients was 41.60 year. study population consisted of 24 (40 %) men and 36 (60 %) women. The mean intraocular pressure was 13.52 & 13.72 mmHg for GAT, and 16.64 & 17.44 mmHg for Air puff respectively. The range of measurements by GAT was from 10 to 23 mmHg and by Air puff was 12 to 28mmHg. The difference between IOP measured by two instruments were statistically significant (p=0.000). **Conclusion:** Airpuff tonometer is quick, a non-contact method to measure intraocular pressure and is useful for screening purposes and postoperative case but the measurements should be confirmed with Goldmann applanation tonometer for accurate labelling of intraocular pressure.

Keywords: Glaucoma, Intraocular pressure, Goldmann applanation tonometry, Non-contact air puff tonometer.

[BSMMU J 2015 ; 8 (1) : 56-60]

Introduction:

Intraocular pressure (IOP) is one of the most important parameters in the diagnosis and treatment of glaucoma¹. Glaucoma has been established as the second leading cause of blindness³. The treatment of glaucoma focuses mainly on lowering intraocular pressure (IOP). The target IOP is often set to a level 20% to 30% of IOP reduction, and consequent large IOP reduction beyond 30% or even 40% in cases of advanced glaucoma². The different methods of tonometry are: Goldman Applanation tonometry, Noncon-

tact (air-puff) tonometry, Perkins tonometry, Tonopen tonometry, Transpalpebral tonometry.

Goldmann Applanation Tonometer is the method of choice in the ophthalmological clinical settings. Based on Imbert-Fick principle, the Goldmann tonometer assesses the intraocular pressure by measuring the force necessary to applanate a fixed area of cornea³. Air puff tonometry is based on the principle of Applanation, the central part of cornea is flattened by a jet of air to measure the level of IOP⁵. The main advantages of non-contact tonometers are that they are non-invasive and thus comfortable for the patient with a minimal risk of infection. The performance of non-contact tonometry and the interpretation of results are easier than with Gold-

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mann tonometry.

The reliability and stability of IOP measurements is very important. Normal IOP is important to maintain the shape of the eye and normal visual function. Long-term high IOP can cause irreversible damage to the retinal ganglion cells and postganglionic nerve fibres. Studies have shown that for every 1 mmHg reduction in IOP, visual field damage can be reduced by 10%.

Pooled data from large epidemiologic studies indicate that the mean IOP is approximately 16 mmHg; however, these pooled data have a non-Gaussian distribution with a skew toward higher pressures, especially in individuals over the age of 40. The value 22 mmHg has been used in the past to both separate normal and abnormal pressures and define which patients required ocular hypotensive therapy. This division was based largely on the erroneous assumptions that glaucomatous damage is caused exclusively by pressures that are higher than normal and that normal pressures do not cause damage.

Methods:

This was a non-interventional, comparative cross sectional study conducted Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh. Consecutive subjects attending the BSMMU community ophthalmology OPD were included in the study. IOP was measured by non-contact (air puff) tonometer and a slit lamp mounted GAT in all the subjects. The study samples were selected by convenience sampling who presented for check-up in the Eye Department of community ophthalmology, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh. Inclusion criteria includes, best corrected visual acuity (BCVA) at least 6/6, refractive error within $\pm 2D$ spherical and within $\pm 2D$ of astigmatism.¹⁵, the subjects with normal fundus on +90D examination. Exclusion criteria includes, refractive error $> \pm 2D$, any active eye disease like uveitis, corneal disease, infection, discharge, etc, any condition that did not allow taking measurements. Both the procedures were explained to the subjects and an informed consent was taken according to the Declaration of Helsinki, All the measurements were taken from 9 AM to 10 AM to avoid the effect of diurnal fluctuations on IOP. Measurement by Air puff tonometer this was done first in each patient followed by Goldman applanation tonometry. It was done before applanation tonometry because touching the cornea by

applanation prism might have effect on non-contact (air puff) tonometer readings.¹⁶⁻²² The subjects were made to sit on a chair and IOP was measured by non-contact (air puff) tonometer. The average of three measurements was taken for analysis. Measurement by GAT: the applanation tonometry was done by a slit lamp mounted applanation tonometer on Haag-Streit R-900 device (Haag-Streit, Koeniz, Switzerland). The subjects were seated comfortably on the slit lamp after explaining the procedure. Proparacaine (0.5%) eye drops were instilled as an anaesthetic agent followed by application of sterilized strip of Fluorescein (1%) in the inferior fornix of the eye.^{2,3,23} The applanation prism tip was cleaned by alcohol to avoid transmission of infection.²³ The time difference of at least 15 min was kept between the two measurements. The readings were taken by properly calibrated GAT. The standard clinical methods, recommendations and guidelines of the manufacturers were followed for appropriate readings.²³ Three different readings for the designated eye were and the average was calculated which was used for statistical analysis.

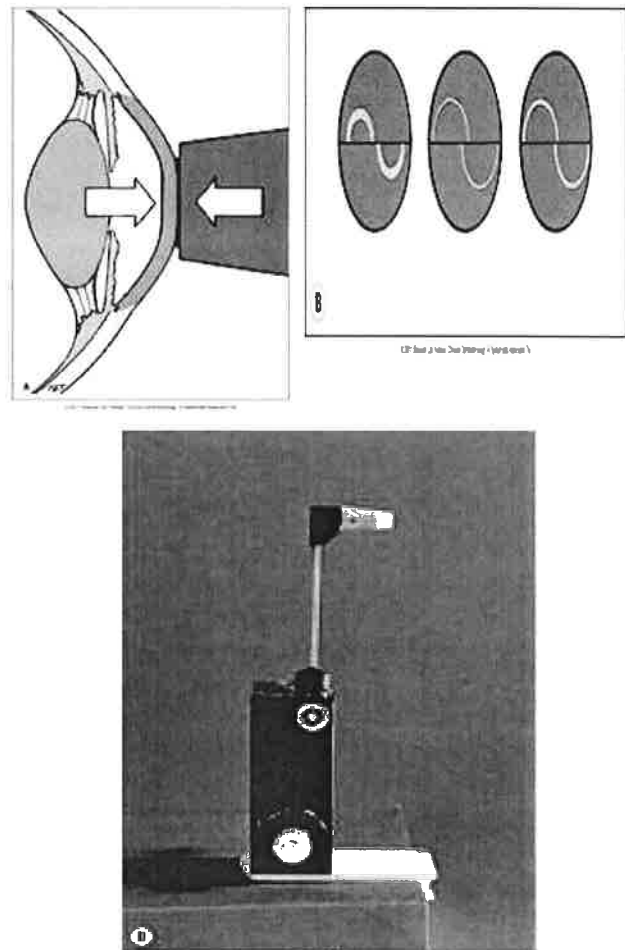


Fig: 1 Goldman Applanation tonometry



Fig: 2 Non Contact Airpuff Toometer 200(NIPPON)

The data were entered in Microsoft excel spread sheet. Statistical analysis was done with SPSS 16 software (Chicago,IL, USA). The mean IOP measured by each instruments were compared. Student's t-test was performed to compare the mean IOP obtained with two methods. was used to explore correlation between the two methods of IOP measurements. A p-value of <0.05 was taken as significant.

Results:

A total of 120 eyes in 60 patients were studied. The mean age of the patients was 41.60 year. study population consisted of 24 (40 %) men and 36 (60 %) women. The mean intraocular pressure was 13.52 & 13.72 mmHg for GAT, and 16.64 & 17.44 mmHg for Air puff respectively. The range of measurements by GAT was from 10 to 23 mmHg and by Air puff was 12 to 28 mmHg. The difference between IOP measured by two instruments were statistically significant ($p=0.000$).

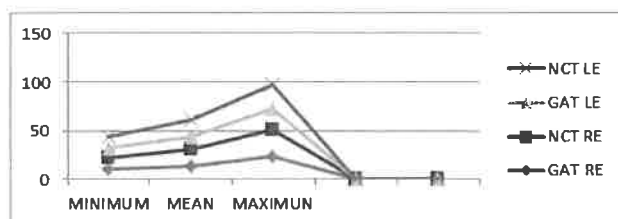


Fig : 3 IOP trend

In our study a total of 120 eyes in 60 patients were

studied. The mean age of the patients was 41.60 year. study population consisted of 24 (40 %) men and 36 (60 %) women (Table-01,02, Figure-03).

Table - I

Results of IOP in GAT and airpuff with mean and number of patient

	N	Mean	Std. Deviation
patient age	50	41.6000	14.44483
GAT in right eye	50	13.5200	3.23400
GAT in left eye	50	13.7200	3.11048
Air Puff inRight eye	50	16.6400	3.73489
Air puff in left eye	50	17.4400	3.44140

The mean intraocular pressure was 13.52 & 13.72 mmHg for GAT, and 16.64 & 17.44 mmHg for Air puff respectively (Table -04,05 Figure - 04). The range of measurements by GAT was from 10 to 23 mmHg and by Air puff was 12 to 28 mmHg. The difference between IOP measured by two instruments were statistically significant ($p=0.000$)(Table 05).

Table - II

Results of IOP in GAT and airpuff with mean and number of patient with P value and CI

Test Value = 0				95% Confidence Interval of the Difference	
t	df	Sig.(2-tailed)	Mean Difference	Lower	Upper
GAT in left eye	31.190	.000	13.72000	12.8360	14.6040
Air puff in left eye	35.834	.000	17.44000	16.4620	18.4180

Discussion :

Non Contact Air Puff Tonometer are usually commonly used in day-to-day ophthalmic clinic practice. Its accuracy is very good even in edematous or irregular corneas, less dependent on corneal thickness, can be used in upright or supine positions, no need of Fluoresce. It does not require slit lamp and topical anaesthesia. Disadvantages of Pneumatonometer is expensive. 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 topical 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 and their correlation with measurements obtained with the GAT in subjects with and without glaucoma. Babalola OE et al, the accuracy of two non-contact tonometers, including the Reichert AT550, Goldmann applanation tonometer, and a Perkins tonometer was tested in a young normal population. The results showed a high level of agreement between the AT550 and Goldmann applanation tonometer⁶. Masood Alam Shah et al in their study, concluded that intraocular pressure readings obtained by AT550 are comparable clinically with those obtained by the Goldmann applanation tonometer in a population having intraocular pressure within the normal range. In their study the difference between IOP measured by two instruments were statistically significant ($p=0.03$). In the study by Salim et al a close level of agreement in the normal range of IOPs was observed, with an increased variation as the magnitude of measurements increased. Our data also highlighted that there were 86.4% of eyes having IOP variations within ± 3 mmHg. Study done by Moseley et al. showed that 71% of the patients had IOP variation within ± 3 mmHg. Babalola et al. found that 79% of patients were within ± 3 mmHg. The mean of the paired difference in IOP was lesser in IOP less than 18 than above that. These differences in IOP were more common at the higher IOP ranges than the IOP in lower teens. This indicated that in most of the patients the Keeler's Pulsair NCT measured IOP correctly if it was within normal range but one has to become cognisant if measured IOP is 18 mmHg or above with Pulsair NCT. They concluded that NCT is a fair tool for screening purposes in community practices as can be easily used by residents and health care personals. The reliability of the instrument decreases if IOP is in the range of higher teens. In this study we also observed IOP variations within ± 3 mmHg and differences were also statistically significant ($p=0.000$)

Conclusions :

Compared to non-contact air-puff tonometer, the Gold-

mann applanation tonometer is a reliable and consistent technique for measurement of intraocular pressure. Airpuff tonometer is quick, a non-contact method to measure intraocular pressure and is useful for screening purposes and postoperative case .

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