Correlation of Intraocular Pressure measured by Schiotz Indentation Tonometer and Goldmann Applanation Tonometer

INTRODUCTION:

Glaucoma is a common cause of permanent vision loss worldwide, ranking second after cataract. Around 40 million people aged 40 and older either have glaucoma or are at risk of developing it.[1] Intraocular pressure (IOP) is a main risk factor which can be modified in glaucoma. Clinical trials have shown that even a slight increase in IOP can lead to damage to the visual field and progression of the disease. Therefore, precise measurement of IOP is important for predicting and monitoring disease progression. [2]

Glaucoma ranks as 2nd most common cause of irreversible vision loss worldwide, with prevalence in South India ranging from 1.62% to 2.6%. [3][4]

It is characterized by chronic optic neuropathy involving structural and functional changes in optic nerve head, where elevated intraocular pressure (IOP) is a significant risk factor.

Normal IOP is crucial for maintaining ocular shape and visual function, as prolonged elevation can lead to irreversible damage to retinal ganglion cells and nerve fibers.[5] Accurate measurement of IOP not only guides treatment initiation but also monitors treatment effectiveness. [6]

Advancements in tonometry instrumentation over recent decades aim to enhance the accuracy of IOP measurement, yet ocular and non-ocular factors can complicate measurements and treatment. [7]

In India, public health institutions, particularly those serving underprivileged communities, rely heavily on rural camps for population-wide screening of vision disorders. In these settings, cost-effectiveness of tonometer plays a crucial role in device selection. Often, due to limited manpower, optometrists perform rapid IOP measurements, raising questions about the accuracy of cheaper, user-friendly tonometer. Assessing the performance and reliability of various tonometer is hence important for proper management of patients.

MATERIALS & METHODS:

- The cross-sectional observational study was conducted at a tertiary care rural hospital after obtaining the approval from the Institutional Ethics Committee from January 2024 to October 2024
- 200 eyes of 100 participants were included in the study
- Written informed consent was obtained from all the participants
- Under topical anaesthesia (proparacaine hydrochloride 0.5%), IOP was measured using GAT, with the patient seated on a slitlamp, after staining the conjunctival sac with a sterile fluorescein sodium (1 mg) ophthalmic strip.
- Then, IOP measurement using Schiotz tonometer was taken in the supine position by placing the tonometer footplate over the center of cornea.
- All the measurements were taken by a single observer.
- Right eye was measured first, followed by left eye.

INCLUSION CRITERION:

1.Patients above the age of 40 years of either sex

EXCLUSION CRITERION:

1.Patients having corneal pathology (corneal opacities, corneal ulcer, keratoconus etc.)

2.History of previous corneal surgery including refractive surgery

3.Microphthalmos

4. Blepharospasm

5. Manifest nystagmus

6. Any current conjunctival or corneal infections

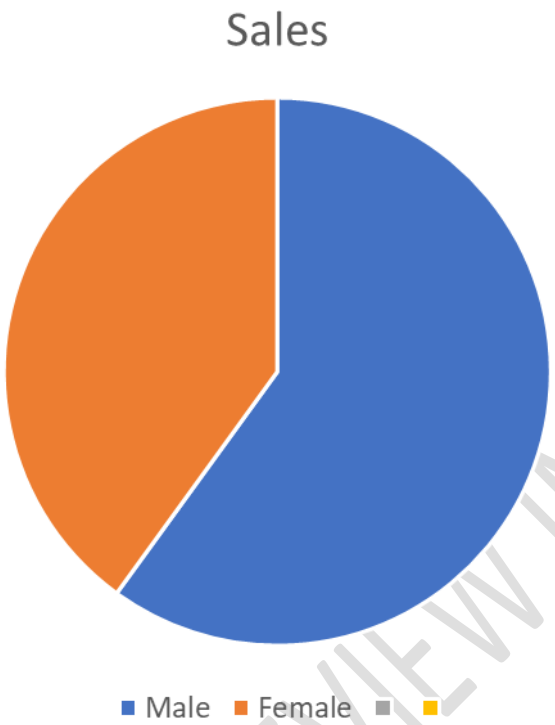
7. Patients who have recently undergone intraocular surgeries (within 2 months)

8. Patients with active intraocular inflammation

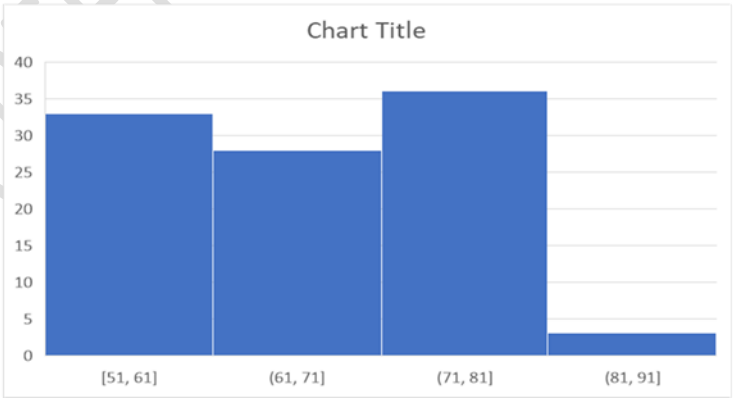
- The results of both the investigations were analysed by Microsoft Excel Program to determine mean and derivations
- Schiotz IOP measurements were compared with those obtained by Goldmann applanation tonometer which was assumed to be the gold standard
- A Bland-Altman plot was constructed to investigate the existence of any systematic difference between the 2 tonometry methods

RESULTS:

- This study included 200 eyes of 100 participants of which 60 were males and 40 participants were females

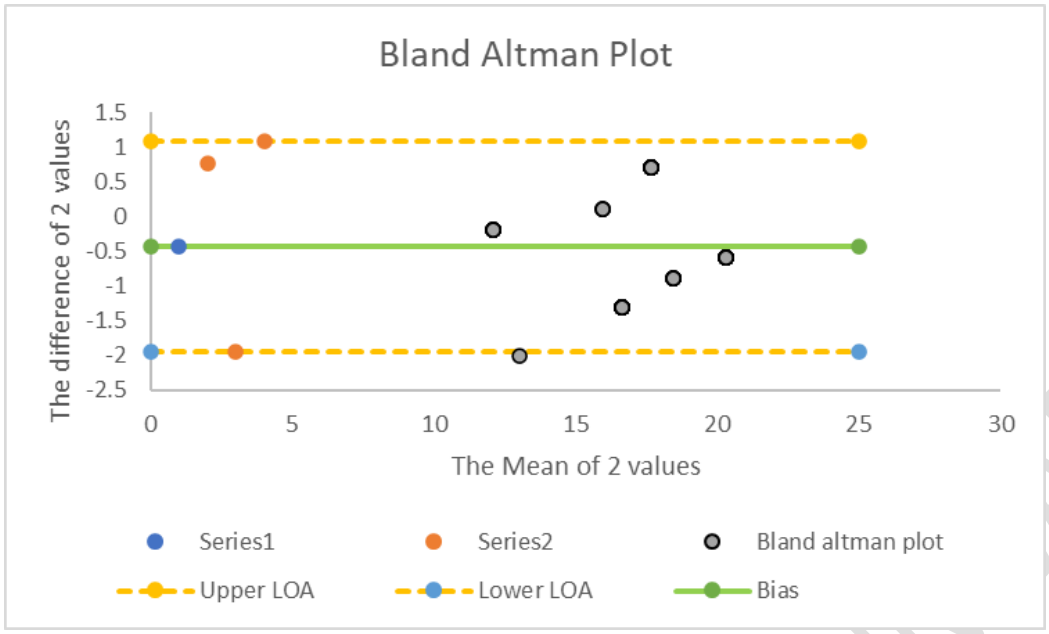


- Age distribution- Mean age in our study was 67.05 ± 9.08 years

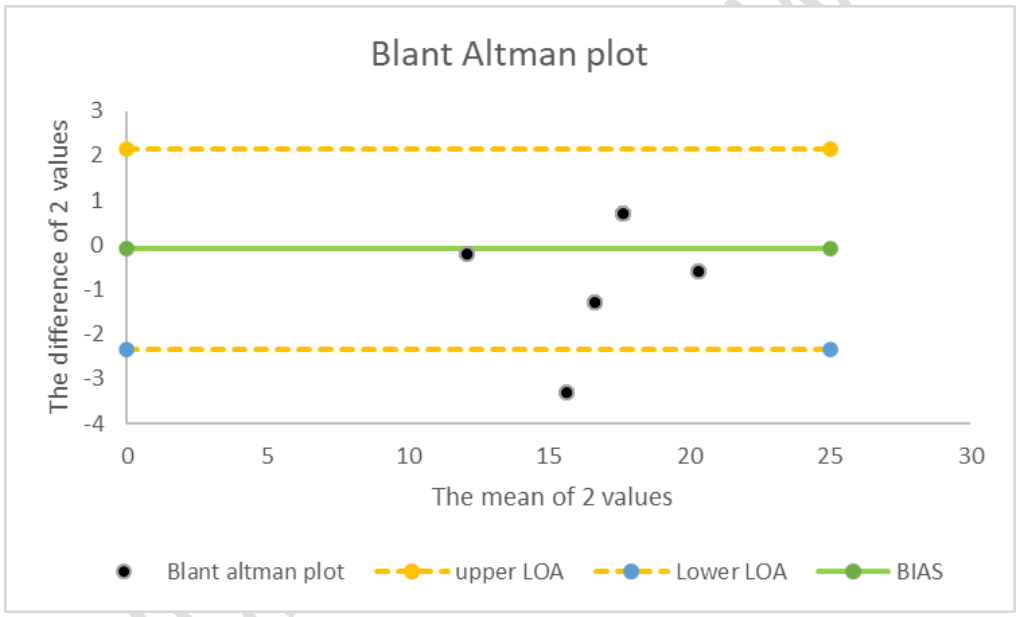


- The mean IOP as measured by GAT in RE was 17.2 ± 2.36 mmHg and in LE was 17.12 ± 2.24 mmHg
- The mean IOP as measured by Schiotz tonometer was 17.64 ± 2.36 mmHg in RE and in LE, it was 17.22 ± 2.01 mmHg.
- On Bland Altman plot, there was no any systematic difference found between the IOP measured by Goldmann applanation tonometer and that by the Schiotz tonometer

Bland Altman plot for RE



Bland Altman plot for LE



- For Right eye, the correlation coefficient between IOP by Goldmann applanation tonometer and Schiotz tonometer was 0.946413 ($P < 0.001$).

- For Left eye, the correlation coefficient between IOP by Goldmann applanation tonometer and Schiotz tonometer was 0.860304 ($P < 0.001$).

DISCUSSION:

- As glaucoma is one of the leading causes of irreversible blindness worldwide so proper screening beforehand is of utmost importance.
- Although multiple risk factors can account for the susceptibility to glaucomatous change, IOP is the only risk factor that is amenable to treatment by pharmacological and surgical measures
- Different tonometers are being developed over the years, each has its own advantages and disadvantages.
- Goldmann applanation tonometer is considered to be the current gold standard.
- But there are certain disadvantages for its use specially in case of community screening programme like dependency on slit-lamp, change in the size of mires because of inadequate or excess fluorescein staining etc
- Schiotz tonometer is another user-friendly instrument available for use by both the ophthalmology trainee and the optometrist with advantages of ease of operability, portability and affordability
- In this study, we have compared Schiotz indentation tonometer to Goldmann applanation tonometer in the same set of patients and determined the agreement between the two by Bland-Altman method
- We found positive correlation between IOP readings obtained by Goldmann applanation tonometer and Schiotz indentation tonometer which was statistically significant ($P < 0.001$)
- Sirisha Senthil et al. similarly compared IOP measured by Schiotz tonometer with IOP by GAT and found that values were correlating well with a mean difference of -1.21 mmHg [8]
- A.R. Rajalakshmi er al. also found the good agreement between the two tonometers[9]

CONCLUSION:

- In conclusion, IOP readings using Schiotz indentation tonometer do correlate with that of Goldmann applanation tonometer.
- Hence, as being portable and relatively cost effective, Schiotz tonometer can be used in rural settings for baseline IOP measurement.

FINANCIAL SUPPORT AND SPONSORSHIP:

Nil.

CONFLICTS OF INTEREST:

There are no conflicts of interest.

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