

SITA STANDARD AS A SCREENING TOOL IN GLAUCOMA EVALUATION- A PROSPECTIVE STUDY TO DETERMINE ITS SPECIFICITY AND SENSITIVITY

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ABSTRACT

BACKGROUND

Characteristic visual field defects are the primary criteria to diagnose glaucoma and to monitor its progression. With the increased awareness about this disease and inclusion of glaucoma evaluation in the routine clinical examination of all patients above 40 years of age, there is a need for faster screening algorithm with good reliability, reproducibility, specificity, and sensitivity.

The aim of this study was to determine the sensitivity and specificity of SITA Standard protocol and evaluate its use as a screening tool for POAG.

MATERIALS AND METHODS

A 1-year prospective study conducted in the Glaucoma clinic of a tertiary care hospital in Northern Karnataka, where all newly diagnosed cases underwent sequential automated perimetry with a full threshold and SITA Standard algorithm. Eye with a more severe defect was considered for analysis.

RESULTS

60 eyes of 60 patients were enrolled. Mean age of presentation was found to be 63.63 years. The sensitivity of SITA Standard was found to be 95.24% while specificity was found to be 94.44%. The test time was reduced by 45.84% when compared to Full Threshold Algorithm.

CONCLUSION

SITA Standard reduces the test time by almost half with reliable results and thus provides a good option to be used as a screening test in glaucoma clinics.

KEYWORDS

HFA, Perimetry, POAG, SITA, Glaucoma.

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BACKGROUND

With Glaucoma being the 2nd leading cause of visual impairment worldwide after cataract, and thus the largest cause of irreversible blindness, there is a need for incorporation of screening protocol in the routine clinical examination of demography at risk.¹ The natural course of the disease is such that the central vision is last to be affected, and thus at the time of diagnosis there is considerable loss of visual field which has already taken place.²

Systemic assessment of visual field or perimetry is an integral part of the diagnosis, management, and prognosis of glaucoma. This assessment requires being accurate, reproducible and co-relating.

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An ideal perimetry test should also be completed in such a time frame that it negates patient's fatigue. Over the course of time, such assessment has progressed from crude methods like confrontation test to more sophisticated Standard Automated Perimetry (SAP).

White on White standard automated perimetry has been devised in two systems: Humphrey Zeiss Systems (Popularly known as Humphrey field analyser-HFA) and Haag-Streit International Systems (Popularly known as Octopus perimeter). Perimeters measure sensitivity by stimulating the visual field at multiple locations and multiple variables are taken into account. The stimulus provided can be varied depending on the different testing algorithm. Perimetry with HFA can be performed using various such algorithms like Full threshold, FASTPAC, Swedish Interactive Threshold Algorithm (SITA) which again can be SITA Standard (SS) or SITA Fast (SF).³ Different algorithms have different test duration and can be employed in patients with different levels of concentration abilities and cognitive functions. But the faster test should not compromise with the sensitivity of the test and should give reproducible results.

With the time constraints of a comprehensive evaluation, a consensus has to be reached about which

algorithm of visual field analysis as a standard can be used for routine screening of the cases which are suspects of glaucoma, and the population at risk.

Our study aims to compare the results of Full threshold and SITA standard algorithm in terms of sensitivity, specificity and time duration required for the test.

MATERIALS AND METHODS

This was a 1-year prospective study conducted in the Glaucoma clinic of a tertiary care hospital in Northern Karnataka. All the newly diagnosed cases of Primary Open Angle Glaucoma during January-December 2010 were enrolled. The patients with a history of colour vision defects, refractive error (>5D spherical or >2.5D cylindrical), amblyopia, dense cataracts, retinal pathologies, or on medications that can potentially affect optic nerve were excluded.

A standard Full Threshold (FT) test using program 30-2 with size III stimulus, white on white perimetry was performed using a Humphrey Visual Field Analyzer and calculations of the total and pattern deviation plots and global indices {mean deviation (MD) and corrected pattern standard deviation (CPSD)} were done. After a rest period of 15 minutes the patient underwent SITA standard test using program 30-2 on the same machine with similar stimulus size, and calculations of the total and pattern deviation plots and global indices {mean deviation (MD) and pattern standard deviation (PSD)} were done. Eye with a more severe defect in cases with bilateral POAG was considered for statistical analysis. All data were entered into IBM SPSS v17.0 and statistical analysis was done, where sensitivity and specificity of SITA Standard were calculated taking FT test as Gold Standard.

RESULTS

60 eyes of 60 patients of POAG were enrolled in the study. Mean age at presentation was 63.63±9.81 years, and no patient presented below 40 years of age. Out of the 60, 41 (68.33%) patients were male and 19 (31.67%) were female. 20 (33%) patients had Diabetes, 31(51.66%) patients had hypertension while 37(61.67%) had a history of the smoking present. 14(23.33%) cases had a family history of glaucoma. (Table 1)

In the present study, 41 patients (68.33%) had IOP in the range of 25 to 29 mmHg, 10 patients (16.67%) had IOP in the range of 21 to 24 mmHg and 8 patients (13.33%) had IOP in the range of 30 to 34 mm Hg. More number of patients (68.33%) had IOP in the range of 25 to 29 mmHg and 1 patient had IOP ≥ 35 mm Hg. Mean IOP of 60 patients was 27.50 ± 3.30 mmHg. (Chart 1)

The Sensitivity of SITA Standard was 95.24% in detecting visual field defects in POAG patients with the Full Threshold Algorithm as the gold standard, While the Specificity was 94.44%, with a diagnostic accuracy of the test being 95% (Table 1) SITA Standard detected a visual field defect in 1 case (false positive) which was not detected by Full Threshold which is currently considered gold standard.

The SITA Standard reduced test-taking time by a mean of 6.57 minutes i.e. 45.84% and it reduced test-taking time at a statistically significant level ($p < 0.0001$) when compared to Gold Standard Full Threshold test, without significant difference in the mean deviation. (Table 2)

| Risk Factor | Present | Absent |
|------------------|---------|--------|
| Family History | 23.33% | 76.66% |
| Diabetes Miletus | 20% | 80% |
| Hypertension | 51.66% | 48.33% |
| Smoking | 61.67% | 38.33% |

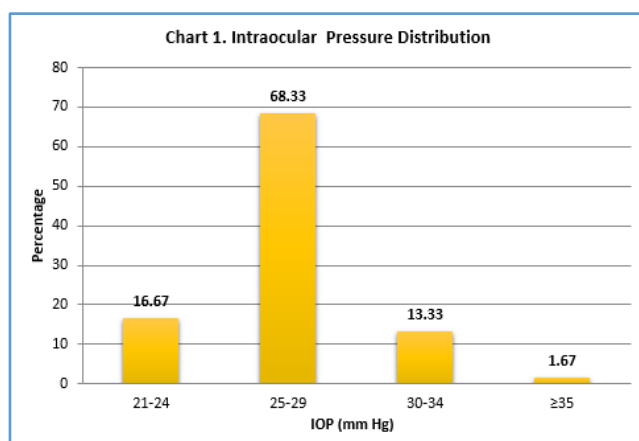
Table 1. Risk Factors for Glaucoma

| SITA Standard (SS) | Full Threshold (FT) | | |
|--|--|---|-------|
| | Number of patients showing the presence of visual field defect with FT | Number of patients showing the absence of visual field defect with FT | Total |
| Number of patients showing the presence of visual field defect with SS | 40 True positives | 1 False positives | 41 |
| Number of patients showing the absence of visual field defect with SS | 2 False negatives | 17 True negatives | 19 |
| Total | 42 | 18 | 60 |

Table 2. Sensitivity, Specificity and diagnostic accuracy of SITA Standard vs Full Threshold Protocol

| | |
|--|---|
| Sensitivity = | $\frac{\text{True Positive}}{\text{True Positives} + \text{False Negatives}} \times 100 = 95.24\%$ |
| Specificity = | $\frac{\text{True negatives}}{\text{True negatives} + \text{False positives}} \times 100 = 94.44\%$ |
| Predictive Value = of a Positive Test | $\frac{\text{True positives}}{\text{True positives} + \text{False positives}} \times 100 = 97.56\%$ |
| Predictive Value = of a Negative Test | $\frac{\text{True negatives}}{\text{True negatives} + \text{false negatives}} \times 100 = 89.47\%$ |
| Diagnostic Accuracy of Test = 95.00% | |
| Table 2. Sensitivity, Specificity and diagnostic accuracy of SITA Standard vs Full Threshold Protocol | |

| | Full Threshold (FT) Algorithm | SITA Standard Algorithm |
|---|--------------------------------------|--------------------------------|
| Test taking time in minutes | 14.33 ± 3.31 | 7.76 ± 1.44 (P < 0.0001) |
| Mean Deviation (dB) | -13.47 ± 9.80 | -13.55 ± 9.91 |
| Table 3. Comparison of the Time Duration of the Test and Mean Deviation of Visual Field Loss of SITA Standard Vs. Full Threshold | | |



DISCUSSION

Visual field analysis for glaucoma has been evolving and standardizing over time, from the crude confrontation method to reproducible Goldmann's perimetry to the current gold standard of Automated Perimetry.

Characteristic visual field loss with corresponding RNFL loss now form the cornerstone of diagnosing Glaucoma, and thus faster and reliable tests to screen the patients are the need of the hour.

Glaucoma prevalence increases along the age till 6th to 7th decade, after which it falls. Prevalence of POAG in less than 40 years increased to 3-folds in next decade i.e. 41-50 years, showed a study by Wilson M.R.⁴ The mean age of presentation of POAG patient was found to be 63.8 years by Suzuki et al⁵ which co-related well with our study with the mean age being 63.63 years.

Presence of POAG among first-degree relative is now an established risk factor for glaucoma, with Kellerman reporting up to 25% of the patients having a positive family

history, similar to the findings of the present study which has 23.33% co-relation.⁶

The presence of high IOP was the only way of suspecting and monitoring glaucoma for a long time. Even with the advent of sophisticated diagnostic and better management modalities of glaucoma, IOP is considered as the only medically modifiable risk factor which has proven efficacy on the rate of progression of glaucoma.

Positive co-relation has been proven between diabetes and glaucoma in the metanalysis by Zhou et al which concluded that incidence of glaucoma rises by 36% in diabetics.⁷ Deb et al reported 2-3 times increase in the incidence of glaucoma in a hypertensive population.⁸ Lin et al reported a 50.5% incidence of hypertension in patients of POAG, similar to our results of 51.66%.⁹ Smoking causes the release of free radicals and thus exacerbate the retinal ganglion cell loss. Suzuki et al reported about 42.85% of POAG patients having a history of smoking, while our study showed the incidence to be 61.67%.⁵

Thus, the demography above 40 years of age, having higher IOP, diabetes, hypertension or history of smoking form our target population requiring the screening for glaucoma during routine evaluation.

Sharma et al¹⁰ reported the sensitivity and specificity of SITA standard in 102 patients where Sensitivity for detecting a glaucoma defect ranged from 83% to 93%, and specificity ranged from 79% to 96% depending on the diagnostic criteria used. A similar study by Sekhar et al¹¹ of 48 glaucoma patients using Full Threshold as the gold standard, the SITA standard algorithm yielded a sensitivity of 95%. Budenz et al¹² found that sensitivity of SITA Standard in detecting glaucomatous visual field defects was 98% and specificity was 96% in 82 glaucoma patients using criteria that was similar to criteria used in the present study. In our study, the sensitivity of SITA Standard in detecting glaucomatous visual defects was 95.24% in primary open angle glaucoma patients while the specificity was 94.44%.

Budenz et al¹² in their study on 82 glaucoma patients showed that test time saved with SITA standard was approximately 47 % compared with Full Threshold while Sekhar et al 11 in a study on 48 glaucoma patients showed it to be 53.12%. Sharma et al¹⁰ showed a mean decrease of 48.8% with the minimum time taken to complete the SITA Standard was 4.1 minutes. In our study, the mean test-taking time with Full Threshold algorithm was 14.33 ± 3.31 minutes and for SITA standard algorithm, it was 7.76 ± 1.44 minutes, showing the mean reduction of 6.57 minutes i.e. 45.84%. (p-value < 0.0001)

Budenz et al also compared Mean deviation(MD) and found that Mean deviation was shown to be only slightly better in SITA Standard algorithm compared with Full Threshold algorithm which was 0.7dB.¹² Bengtsson and Heijl found that Mean deviation(MD) was 1.2 dB higher using SITA Standard than Full Threshold in their study of 330 subjects.¹³ Given the results of these studies, there appears to be little, if any, difference between the FT and SITA algorithms in mean deviation scores, which was correlating with our study, where MD value was 0.08 dB better in SITA

Standard fields compared with FT fields in POAG patients with p-value of 0.9667 which was not statistically significant.

CONCLUSION

With our study and corroborative evidence from other similar works, it can be concluded that SITA Standard is a faster alternative to Full Threshold strategy for screening glaucoma cases, with good sensitivity and specificity and similar results.

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