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The diagnosis simple glaucoma or glaucoma simplex is by no means simple, and diagnosis in the early stages may be rather elusive. Still the etiology of chronic simple glaucoma is very largely a matter of speculation in spite of the large volume of research work which has been done, over the last hundred years.

In view of poor understanding of etiopathogenesis of chronic simple glaucoma, attempts made at the early diagnosis of disease are quite frustrating. Problem becomes more difficult because of the very slow course of disease process keeping patient ignorant about the actual damage. Although chronic simple glaucoma itself is never lethal yet great amount of morbidity is caused by it.

The diagnosis of glaucoma is not based upon a single parameter but it is always made on the basis of several parameters viz intracocular tension, field defects, appearance of optic cup and disc etc. The knowledge of relationship of
these parameters will be useful addition to the present diagnostic armamentarium for chronic simple glaucoma. This study, therefore, has been an attempt to find out relationship between various ocular parameters and thus in turn to achieve an early diagnosis in glaucoma suspects.

Total 60 studied patients of either sex were classified according to their mode of presentation into 2 groups i.e. group I, group II (detail given earlier).

The group I had 50 cases (83.33%) and in group II consisted of 10 cases (16.67%). Thus the majority of cases were in group I which have a high risk as to eventual glaucomatous loss. Various workers have also noted the same, Linner and Stromberg (1967), Leychecker (1967), and Kitasawa et al (1977).

The average age of the total patients was 45.66 years (S.D. ± 11.52) with a non significant difference between age of males and females. Mean age of males was 45.57 years as to 44.15 years of female. Thus these were the cases in which one can assume beginning of degenerative and sclerotic changes as also stated by Duke-Elder(1976)
He has also defined glaucoma as a disease of senescent and degenerative age group. Male/ female ratio was 180.918. Slightly higher number of males may be attributed to over-all more awareness of male population because of higher literacy status.

The chief presenting complaint in majority of cases was the diminution of vision (78.33). Almost all of these cases consulted for difficulty in near vision, however, on further investigations they were also found to have defective distant vision. Only 22.67 percent came with others complaints. After elimination of refractive errors, approximately all cases (96%) attained normal vision (6/9 or better in bad eye). Thus we can say, as such, chronic simple glaucoma is a symptomless disease in early stages, Elkington (1975) did have the similar view. All the 120 eyes had open angles as observed by Goldmann 3 mirror Gonioscope. The mean of angle was 2.423. Thus all these cases had not excludible angles.

104 eyes (86.67%) had intraocular tension of 21 mm of mercury or more while remaining 16 eyes (13.33%) were with intraocular tension of $\angle$ 21 mm
of mercury. These were from both the groups. The mean intracocular tension of right eyes was 23.983 mm of Hg (SD = 4.051) and that of left eyes was 23.288 mm of Hg (SD = 2.926). This was significantly higher than the normal range of mean values. Mean values ranging from 14.0 mm of Hg to 18.0 mm of Hg have been reported in normal population by various workers. Bunjes (1939), 14.5 mm of Hg; Abrahamson and Abrahamson (1939), 16.0 mm of Hg; Levene (1961), 15.6 mm of Hg; Amaly (1962), 15.92 mm of Hg; Amaly and Salasen (1963), 17.3 mm of Hg.

There was a strong positive relation between the intracocular pressure and presence of field defect. \( \chi^2 = 14.992 \text{ DF} = 8 \ P \leq 0.001 \) (Table 20). Increase in intracocular pressure was associated with a similar increase in percentage of eyes with field defect.

Thus despite the increasing accuracy and availability of other methods and the ultimate dependence upon perimetry, the early detection of glaucoma is still largely dependent upon routine tonometry. However, Scheie determinations of
intracocular pressure may be wrong because of deviations from the assumed average value for axon granularity, but Goldman appplanation tonometry reveals the correct intracocular pressure thus in turn a and results in more accurate diagnosis.

The majority of eyes (89) were having pupil diameter in between 3.9 to 3.9 with a mean pupil diameter of 4.085 mm (SD ± 0.584). This was within the normal range.

There was an increased frequency of large C/D ratio i.e., cup/disc ratio greater than 0.3 (Table 10). From the total of 120 eyes studied, 64 (53.3%) eyes had cup/disc ratio greater than 0.3. The eyes not having cup/disc ratio greater than 0.3 also showed a tendency towards the bigger cups and most of the eyes (40%) from this group had a cup/disc ratio 0.2 to 0.3 (Table 10). This tendency of shift to a larger C/D ratio may be because of the fact that the eyes taken into this study presented with a greater risk of developing glaucoma.

On comparing the C/D ration of affected eyes (either from cases with unilateral or bilateral involvement) with that of eyes with normal visual field,
we observed a statistically significant difference in cup/disc ratio of two groups \( (X^2 = 11.23, \text{ DF } 1, P \leq 0.001) \). Most of the eyes (76.16%) with field defects had a C/D ratio greater than 0.3 with a maximum percentage of eyes (59.10%) belonging to C/D ratio group of 0.4 to 0.5 while majority of the eyes (67.71%) with no field defect were with a C/D ratio in between 0.0 to 0.3 (Table 19). When the cases with visual field involvement were compared with those of having normal visual fields in both the eyes, a statistically significant difference was found in frequency of C/D ratio in two groups \( (X^2 = 11.23, \text{ DF } 1, P \leq 0.001) \) (Table 19). Thus these findings are in accordance with those of Arnaity (1970), Fisher (1970) and Eikington (1975).

Equal numbers of oval (vertically) and round optic cups were seen (Table 11). On further analysis it was found that round cups were usually smaller in diameter as compared to oval cups. The cup/disc ratio of 77.05 percent of round optic cups was within 0.3 whereas, only 15.25 percent oval cups were in this group (Table 15). These findings were statistically significant \( (X^2 = 46.846, P \leq 0.001) \).
When we searched for presence of field loss, 88 percent eyes with round cups had normal fields while in case of oval cups 73 percent had field loss. This percentage of eyes with field defect increased to 79.24 percent when eyes with intraocular tension of more than 21 mm of Hg were taken into consideration (Table 16).

These findings clearly indicate that non-glaucmatous cups are round while glaucomatous cups are vertically oval.

Many author assert the same view in their papers. Kirsch and Anderson (1973) (after examining 40 normal and 80 glaucomatous patients) emphasized the significance of vertically oval cup in early diagnosis of chronic simple glaucoma. Similar was the view of Weisman et al. (1973), and Glester (1975).

Although 21.67 percent of eyes with I.O.P. 21 mm Hg had round optic cup yet field defects were seen (Table 16). These findings are not in accordance with Weisman et al. (1973), Anderson (1973) and Glester (1975). This difference could be due to the fact that though oval cups were there, but these presence could not be demonstrated by the methods used.
The more sophisticated examinations via stereoscopic fundus photographs, projected transparencies etc. would have been able to detect the ovalness.

In 20.76 percent eyes with oval optic cups and raised intraocular tension, no field defects were seen. (Table 16). These may be considered as those cases of ocular hypertension, in which earliest change (change in cup) is evident but no field defect has appeared yet. Similar was the view of Fisher et al. (1970). He stated that probably excavation of disc precedes the development of field defects.

In the individuals either with monocular involvement or bilateral involvement of the visual fields (36 cases), the C/D ratio was larger in one eye than the other in 27 subjects. Thus on the basis of this inequality or asymmetry of two optic cups, we were able to suspect glaucoma in 75% of cases (Table 17). These findings were statistically significant ($x^2 = 19.62$, $P \leq 0.001$). Various workers have noted values ranging from 36% to 68%, Fishman (1970), 36%; Arnnal (1970) 68% and Sharma and Chaturvedi (1982) 52.86%.
In 4 cases (6.6%) asymmetry of optic cups was not associated with field defect. These cases may be considered as normal cases. In normal population asymmetry of cups was also observed by various workers but to a very little extent. In a group of 500 patients, Syedchaker (1964) found asymmetrical cups in 15 (3%) while Amaly and Saydogh (1969) noted asymmetry of two cups in 34 cases.

In the view of foregoing discussion it is clearly evident, that enlargement of the optic cup in open angle glaucoma is not limited to the later stages of the clinical disease but can be detected in the earlier stages, long before the individual becomes aware of this condition. Thus, careful ophthalmoscopic examination for asymmetry of two optic cups, becomes an important and useful tool in the suspicion and detection of this otherwise symptomless disease. Considering the simplicity of this procedure and the high frequency of false positive suspicion by tonometry alone, the clinical usefulness of ophthalmoscopy in early detection of chronic simple glaucoma becomes obvious. This is further emphasized by the innocuous nature of this examination.
It is also evident from the above
description that asymmetry of the optic cup
is a good indicator for detection of glaucoma. So we wish to advocate searching for asymmetry
in glaucoma screening. Its presence, especially
in an ocular hypertensive, should be of itself
an adequate indication for further evaluation.

By Goldmann Kinetic perimetry field
defects were found in 36 cases. Out of these 36
cases, 21 had bilateral involvement and 15 cases
presented with unilateral involvement. Thus total
of 55 eyes suffered from field loss. This relatively
high frequency of field defects may be due to more
biased population selection.

The most common field defect was the
para-central scotoma. This consisted of defects
(at least 10° in diameter) affecting the 5°, 10° or
15° circles, with or without connection with the
isopter or the blind spot as demonstrated by 1/3c.
15 eyes (27.27%) presented with this defect. This
type of defect was also confirmed by the central
field charting using Bjerrum tangent screen. In 11
eyes (20%) this was the only defect while in 4 eyes,
this was associated with some other defects. Thus
In 26% cases with the presence of paracentral scotomas, one could have suspected and diagnosed glaucoma by Goldman perimetry. These findings attest the view of Van Grouw (1969), Troquair (1929), Aniborn and Blum (1947), Bruce (1969). They have also reported paracentral scotomas as an early field defects.

The next most frequent defect was the presence of nasal step. This was detected by 1/2e and in few cases with 1/4e. This consisted of nasal step greater than five degrees at isopter boundary, nasal step within isopter boundary or nasal step continuous with blind spot. Twelve eyes (31.81%) presented with nasal steps. Of which 9 eyes (16.33%) had nasal steps as a lone defect, akin to Le Blanc and Becker (1971) who noticed peripheral nasal field defects with step like features in 36% eyes suffering with open angle glaucoma. Small (1969), Arnal (1971) and Harrington (1971) have also stressed the presence of nasal step as an early field defect.

Similar was the view of Magirian (1970), after examining the nasal visual field of normal and
glaucoma suspects he concluded that nasal step wider than 4° and with a depth of greater than 0.8 log unit is a characteristic glaucomatous field defect.

So, we wish to recommend the use of Goldmann Kinetic perimetry for detection of nasal step which can be used as a sensitive marker in early diagnosis of glaucoma.

The various other field defects found were enlargement of blind spot (10 eyes), bowing of blind spot (8 eyes), arcuate scotoma (7 eyes), arcuate scotoma extending to periphery (2 eyes) and cocconcentral scotoma (3 eyes).

The enlargement and also bowing of blind spot was recorded on tangent screen with 1/2000 or 2/2000 and by Goldmann perimeter using 1/2e target. But these can not be considered as an early glaucomatous field defect, although stated by Bjerrum (1889), Reem (1901) and Pellah (1947) because the size of blind spot varies markedly with the stimulus value so that the general limits for the normal blind spot can not be developed. Such reduction in stimulus value, as it is arrives onto the retinal surface, can be easily produced by
change in lens with age or transmissivity of the entire optical pathway. So that if we project the 1/2e on the perimeter bowl we will actually have an 1/26 value on the retina and the elongated or bared blind spot thus obtained, will be incorrectly considered glaucomatous in character. Amaly (1969) also has the similar view. The fact that these ocular changes are not of uncommon occurrence after the age of 40 years, markedly reduces the clinical significance of an enlarged, elongated, or bared blind spot.

So we can say that these changes, in fact, preclude their use as criteria of the glaucomatous effect of visual function which are to be used in justifying the transition from the stage of suspicion to that of definite diagnosis. By this we may not intended to say that such defects may not also be due to a reduction in the sensitivity of these retinal areas by glaucomatous process. It does mean, however, that non glaucomatous factors of far greater frequency than the disease process produce identical changes and in doing so, markedly reduce their presumed value and destroy their usefulness in establishing the diagnosis of glaucoma.
The various others remaining field defect via arcuate scotoma (7 eyes), arcuate scotoma extending to periphery (2 eyes) & nasalcentral scotoma (3 eyes) cannot be considered as early defects as they were usually seen in those eyes in which diagnosis of glaucoma was not in question. So we can clearly say that early field defects in chronic simple glaucoma as observed in our series were paraocentral scotoma and nasal step.

Thus we would like to advocate visual field examination by Goldmann perimeter for search of paraocentral scotoma and nasal step in early diagnosis of glaucoma. The reproducibility and reliability of visual fields examined by Goldmann perimeter places it at the top. So visual field examination by it becomes a cornerstone in early diagnosis of glaucoma.

Two cases of unilateral glaucoma presented with Gunn pupil. This was a relatively new finding. Only few workers have noted it (Krause et al, 1976; Prywes, 1976).
In the present study the size of pupil was shown to have a poor negative correlation with intraocular pressure ($r = -0.1522, 0.05 \leq p \leq 0$). At the first instance this seems to be quite an alarming finding because we are only aware of dilated pupil in cases of glaucoma. But this mydriasis is only seen in cases with very high intraocular pressure (Charles and Hamasaki, 1970; Rutkowski & Thompson, 1972). As the predominant role of parasympathetic tonus in miosis is known and the fact that the parasympathetic tonus increases with an increase in intraocular pressure, the relationship between pupil size and I.O.P. becomes self-explanatory. This observation does, however, support the view of Fisher et al (1970). They have found a significant negative correlation between size of pupil and intraocular pressure ($r = -0.409, p \leq 0.01$).