DISCUSSION
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Glaucome is one of the common cause of blindness in the middle and elderly age group people. Early diagnosis and its treatment can delay or prevent blindness in many patients of glaucoma. Detailed check up of the eyes in the form of tonometry, ophthalmoscopy, visual field determination and fluorescein angiography can be important in the early diagnosis and treatment of glaucoma. Which can prevent the blindness in the population. A number of workers have described the ophthalmoscopic changes (Armaly, 1967, 1970; Richardson, 1968; Becker, 1970; Kirsch and Anderson, 1973; Weisman et al, 1973 Reed & Spaeth, 1974 etc.) and visual field changes (Traquair, 1938; Armaly, 1967; Aulhorn & Harris, 1967; Portney & Rubenzer, 1973), in the various types of glaucoma.

Many investigators have tried to correlate the pallor & cupping of the optic disc and visual field defects with the fluorescein angiographic filling defects (Mayreh & Walker, 1967; Mayreh, 1969, 1972, 1974; Spaeth, 1975; Schwarts et al, 1977). Fluorescein angiographic observations threw some light on the changes of the optic discs in glaucoma. The present study is an attempt to study the optic disc changes in various types of glaucomas, ophthalmoscopically and fluorescein angiographically and their relation to visual field defects.
This study comprised of twenty five known cases of various types of glaucoma, fourteen being males and eleven females. Most of the cases of the glaucoma has no marked sex difference but there is slight preponderance of males than females (Duke-Elder, 1976). Holst (1947) found 62.3% males, Seveinsson (1959) found about twice as many males as females. Leydhecker (1959) found 58% males and Perkins & Jay (1960) 56.5% males. In our study the males were 56% and females were 44%.

Age of these patients varied from 22 to 79 years with an average of 50.5% (Table-II). Maximum number of patients (36%) were in the age group of 51 to 60 years. The incidence increases after the age of 40. Lehrfield & Reber (1937) found 23.6% in sixth, 37.4 in seventh and 23.6% in eighth decade. In our study 20% were in 5th 36% in sixth and 20% in seventh decade. In most studies, there is either no sexual preference or a slight male predominance. Primary open angle glaucoma is predominantly a geriatric disease, most patients being in their sixth or seventh decade at the time of diagnosis (Payman, 1987).

Various workers have shown the incidence of glaucoma in the different types of population. Bray and Kirber (1951) seen the incidence between 40 to 65 years of age, Simillie et al (1957), Vaughan et al (1957) and Porter (1958) seen
the incidence over 40 years of age, Lukie (1961) seen in all ages. Hollows and Graham (1966) seen between 40-70 years. Dankers et al (1968) analyse 5941 persons over 40 years of age & found both type of primary glaucoma 0.93%, 0.71% had simple glaucoma, 0.17% closed angle and remainder the other type of glaucoma.

Hollows & Graham (1966) found 0.84% glaucoma of all type; 0.43% simple glaucoma and 0.10% closed angle glaucoma.

**Type & Proportion of Glaucoma:**

In our study the patients were divided into 3 groups depending upon the level of intracocular pressure and type of the angle of the anterior chamber, whether wide or narrow.

1. **Group I** - Chronic simple glaucoma
2. **Group II** - Chronic congestive glaucoma
3. **Group III** - Low tension glaucoma

The group I - having 19 cases, group II - having 2 cases and group III - having 4 cases. The ratio of these were 9.5 : 1 : 2.

Various workers shown the different proportions of various types of glaucomas in the different number of population.
Kurland & Taub (1957) found 62% simple and 7% close angle, the ratio was 8.9 : 1.

Hollows & Graham (1966) 51% simple glaucoma and 10% close angle glaucoma the ratio was 5 : 1. This is valuable. Bankes et al (1968) found 76% simple glaucoma and 16% close angle glaucoma ratio was 4.2 : 1.

Our study confirms the reported incidence of Kurland & Taub up to some level, because this study was having small no. of cases and were selected randomly and only those cases were selected, in which we were able to do the angiography.

**Gonioscopic findings**

In our study the open angle glaucoma was 92% and the remaining 8% was of close angle type. The chronic simple and low tension glaucoma patients were having a wide open angle with normal depth of anterior chamber, while the remaining chronic congestive glaucoma patients were having a narrow angle and a shallow anterior chamber. Reeder (1923) and Rosengren (1930) found that patients with acute glaucoma had shallow anterior chamber and those with simple glaucoma had anterior chamber of a normal depth. Barkan (1938), Tornquist (1956) also found the shallow anterior chamber in angle closure glaucoma. Love (1970) also studied a large group of eyes with angle closure glaucoma and confirms the Tornquist work.
**Diurnal variation**

In our study, diurnal variation was positive in 21 cases (84%) and was not much significant in remaining 4 cases (16%). In glaucomatous patients, the variation differs in type and magnitude. All the patients in our study were receiving antiglaucomatous therapy.

Many investigators confirmed that the magnitude is greater in cases of simple glaucoma than normal eyes. Drance (1960) found that the mean diurnal variation in normal eyes was 3.7 mm ± 1.0 mm. Hg. while in 138 patients with untreated simple glaucoma, it was 11 mm. ± 5.7 mm. Hg. In the glaucomatous patients, the variation was less than 5 mm. in 6%; 5-9 mm. in 46%; 10-14 mm. in 28%; 15-19 mm. in 12%; 20-24 mm. in 5% and 25 mm. or more in 3%. These findings have been confirmed by Etienne (1957) and Kata-visto (1964).

Huerkamp (1956) and Davanger (1964) found that the diurnal variation increased in proportion to the mean ocular tension and in certain cases it has been found to reach an excursion of 50 to 60 mm. Hg. (Duke Elder, 1952).

**Cupping & Pallor of the optic disc**

Pallor of the optic disc was present in 80% of cases. It is generally assumed that optic disc pallor is a result of the disappearance of the disc capillaries.
The cupping was present in all the optic discs and was of different grades from mild to marked deep cupping. An increase in size as measured by ophthalmoscopically and by serial fundus photography is an abnormality indicating the presence and progress of glaucoma (Farr, 1965; Hollows and Graham, 1966). 40% of the discs were having large deep cupping with excavation posteriorly and the vertical cup/disc ratio was more than the horizontal. This finding also resembles unto some extent to the study of Kirsch and Anderson (1973). They noted that in many of their patients a vertical elongation of the cup was greater than the horizontal ratio. This finding was also confirmed by the Weisman et al (1973).

Relate of optic disc cupping and pallor with the visual field defects:

Visual field changes from paracentral scotomas to Advanced type of defects were present. No definite sequence was followed and all types of variations were present, producing an indefinite variety of different appearances. The defects in the fields are related to hight of intraocular pressure but gross scotomata may occur when the tension has always been relatively low.

In our study all the patients were having various types of visual field changes. 80% of the optic discs were pallor and all were having various grades of cupping.
The defects were typically associated with both cupping of disc and pallor of the nerve head. When both were present, the defects in the visual fields were always present, this study also confirmed by previous workers (Duke-Elder, 1976). If cupping is present without ischemic pallor, the defects may be very slight or even absent. If pallor is present without or with only a trace of cupping, as may occur in elderly patients, the characteristic defects are present if the patient is glaucomatous.

Hayreh and Walker 1967, Spaeth 1971, Phelps 1972, Hitchings and Spaeth 1977, Schwarts & Fishbein 1977 and many other workers correlate the optic disc changes with visual field loss in glaucoma. The present study simulate the work of previous workers.

**Fluorescein angiographic findings**:  

There was generalized hypofluorescence of all the optic discs in our study by fluorescein angiography, which confirms the work of various workers on glaucoma patients (Hayreh, 1967, 1969; Oosterhuis, 1970; Schwarts, Rieser & Fishbein, 1977; Taluson and Schwarts, 1977) etc.). The hypofluorescence of filling defects were described as relative defects and absolute defects. Three optic discs were having relative defects only (12%); 17 discs were having absolute defects only (68%) and remaining 3 discs were having both types of defects (20%).
defect in the disc varied in size from small circumscribed area to one half of the disc, either superior, inferior, temporal or nasal.

The absolute defects were particularly observed in the early arterial phase and the late venous phase. These types of defects were usually corresponded to areas of severe pallor. It often occurs in the deepest part of cup.

The relative defects were observed when, at full arterio-venous phase, areas of disc were not filled with the same amount of fluorescein as other areas. These defects were commonly present in the nasal rim of the disc.

In this study large number of absolute defects were noted. The size of the defects were from small dense to a large ones involving almost the whole disc. In entirely cupped discs with a large area of pallor, the entire disc appeared dark throughout the whole fluorescein cycle.

Absolute defects were commonly present at the superior and inferior positions, beginning in the wall of the cup and extending to the disc rim and edge.

In this study the eye showed smaller number of the relative defects (16.6%) and the larger number of the absolute defects (83.4%). All the discs had significant
fluorescein filling defects. As the severity of the field defect increased, the proportionate number of absolute defects appeared to increase until eyes with advanced loss of visual field were reached.

The factors such as age, the incidence of systemic diseases including the diabetes mellitus, cardiovascular disease, vascular hypertension etc. were not having any significance with either distribution of discs with absolute or relative defects.

The levels of intraocular pressure before and after the fluorescein angiography had no significant change.

As already mentioned, fluorescence of the optic disc was observed to be related to a varying extent with the changes in the optic disc (Colour & Cupping) and visual fields. The patients who had never had a higher intraocular pressure (Table-4, Group-III) showed more percentage of relative defects, while in relation to this the patients who had a raised intraocular pressure previously at some stage (Table 4, Group I & II), the percentage of absolute filling defects was more. This difference in the percentage of filling defects may be due to comparatively more marked changes in the optic disc and visual field defects in the later group.
COMMENTS:

1. Improved fluorescein angiographic methods of studying the circulation of the eye especially the optic disc will aid in determining the vascular pathogenesis of the visual field defects in glaucoma.

2. Decreased fluorescence of the optic disc both diffuse & localized, as shown by fluorescein angiography, has been documented in patients with advanced and circumscribed field loss.

3. In the pathogenesis of glaucoma only a few small areas of the optic nerve may be involved initially. As disease progresses, more areas of hypofluorescence occur, some become larger and merging with other areas.

4. In contrast to most of the previous studies that have described generalized hypofluorescence of the optic disc in glaucoma, our observations have stressed the evaluation of the fluorescein angiogram by the detection of localized areas of hypofluorescence.

5. The filling defects are correlated with the degree of visual field loss, and the site of the filling defects corresponds with the location of the visual field loss.

6. Fluorescein filling defects represent specific areas of ischemia that progress from relatively impaired circulation to areas of infarct as the visual field loss progresses.
Explanations of hypofluorescence:

Reasons for the areas of hypofluorescence is that these are the areas of decreased blood supply.

The areas of hypofluorescence could be areas of thickened tissue that simply mask the fluorescein, which actually is present with a relatively normal blood supply. This explanation does not valid for filling defects that occur deep in the cup, especially, where little tissue is present.

In support of the hypothesis that filling defects, particularly absolute ones, represent areas of ischemia is their high correspondence with the areas of pallor of the disc. However, areas of pallor do not always correspond to areas of avascularity and this may be attributed to scattering of light by tissues such as glial tissue, so that ophthalmoscopically the disc appears pale. If areas of fluorescein filling defects are areas of ischemia, this concept supports the vascular theory for the basis of the visual field loss.

The importance of relative defects is not clear. They may be a normal variant, representing segmental blood supply to the disc, and have no predictive value. However, they may represent areas of compromise vascular supply to the disc and they may progress into absolute defects as additional vascular compensation proves impossible and visual field defects develop. Thus the number of discs with relative defects diminishes.
The presence of other filling defects that did not correspond to any site of visual field loss can be explained by the hypothesis previously. It was indicated that areas of fluorescein defects may be sites of diminished blood supply or ischemia and perhaps even infarcts. It is possible that those fluorescein defects that do not correspond with any site of loss of visual field may have enough blood supply to maintain the functioning of the nerve fibres so that no visual field loss has occurred. These areas may have diminished blood supply that may be especially vulnerable to additional increase of ocular pressure, and may be associated with new areas of loss of visual field in the future.

The positive correlation of the extent of the areas of the defects and the loss of visual field also supports the concept that the fluorescein filling defects represent areas of ischemia, or perhaps infarcts, with bundles of nerve fibres becoming nonfunctional. A significant difference in areas of fluorescein filling defect existed between eyes with very moderate visual field defects and those with advanced visual field loss. Areas of filling defects also correlated positively with extent of loss of visual field.

This suggests that the fluorescein angiogram provides a direct correlation of the changes in the optic disc with visual field loss.