The primary aim of our study was to find out:

(A) Possible relationship between intraocular tension and diabetes mellitus
(B) If a relation exists then which type of glaucoma is more common in diabetes.
(C) Does the presence of glaucoma in diabetic patients offer any protection from the development of proliferative retinopathy.

Furthermore, we have also seen the effect of duration of diabetes on the development of proliferative retinopathy.

A total of 160 cases were selected, of which 80 were normal nondiabetic persons acting as control, and the remaining 80 cases were diabetic persons serving as study group.

**CASE MATERIAL ACCORDING TO SEX**

It is evident from the table no. 1 that amongst the control group the majority of cases 48 (60%) were males and 32 (40%) were females while in the study group 46 (57.5%) were males and 34 (42.5%) were females. In both the groups the number of male to male and female to female patients are somewhat similar.

**AGE DISTRIBUTION**

Table no. 2 shows that in the control group maximum number of patients were in 51-60 years age group 30 (37.5%) and in 41-50 years age group 21 (26.3%). The probable reason for maximum patients in 51-60 years is occurrence of cataract in eyes patients. In the study group maximum no. of patients 27 (33.8%) were in the 41-50 years age group then in the 51-60 years age group 19 (23.8%). So it reveals that common occurrence of diabetes is 41-50 years of age. In diabetic group most of the patients 41 (51.2%) were below the 50 years of age in comparison to the control 37 (45.8%). This also confirms that diabetes occurs somewhat earlier than 50 years of age.
Although diabetes may occur at any age, surveys indicate that prevalence rises with the age. NIDDM usually comes to light in the middle years of life in western countries while in India it occurs nearly a decade earlier (Park & Park).

**SEX DISTRIBUTION**

It is evident from the table no. 3 that the majority of cases in juvenile diabetes were females (all 2 cases male to female ratio is 0:2) as compared to maturity onset diabetes in which males were predominating (male : female 1.3:1 in 41-50 years age group and 1.7 :1 in 51-60 years age group). Male to female ratio in study group is 1.2 :1 in cases less than 50 years of age and 1.6 :1 in cases above the 50 years of age.

Duke - Elder describes that male : female ratio is 2:3 in juvenile diabetes and also that women are more liable to develop retinopathy. While in other studies Portsmann and Wiese (1954), Keiding et al (1952), Janert et al (1956) there is no difference between the sexes. In south east Asia an excess of male diabetics has been observed but this is open to question (W H O 1980 Techn Rep. Ser. No. 666 Park & Park).

**RETINAL STATUS OF EYES**

Table no. 4 shows the retinal status of case material. Eyes with retinopathy which forms total of 26 (16.25%) eyes of the total case material is in close agreement with the prior studies VIZ Wegene (1921) found the incidence of 8.3% of diabetic retinopathy among diabetics. In 1934 the incidence has risen to 17.7 % (Wegener et al 1934) and in 1945 it was 29.6%. Similarly among diabetic clinic patients the prevalence of diabetic retinopathy in India has been reported from 4 - 28 % (Khosla P.K.et al 1976). At two different retinal clinics in India the prevalence was reported from 28 84% to as high as 79.5% (Rao S.V. et al 1986).

In our study Eyes with background retinopathy was present in all the 26 (16.25%) of cases while background and proliferative (Both) were present in 20 (12.50%) of patients.
RETINOPATHY IN RELATION TO DURATION OF DIABETES

Table no. 5 reveals that the maximum no. of diabetic retinopathy 6 (46.2%) occurred after 11-15 years of duration. Among 13 cases of diabetic retinopathy only 5 (38.4%) cases occurred before the 10 years duration of diabetes (early diabetics) while most of the cases 8 (61.5%) cases of retinopathy occurred after the 10 years duration of diabetes (late diabetics). In the present study we observed that the diabetic retinopathy develops in diabetic patients on an average of 10 years of duration while Christiansons (1961) reported retinopathy to develop on an average age 16.7 years of duration. Kornurup (1955) reported that a minimum of 3 years period is required to develop any retinopathy. (Waite & Beethum 1935, Wegener 1945, J S Friendwald 1950, Lawrence et al 1951, Gardes 1953, Gi scott 1953).

Mehra & Rajshree (1966) also reported retinopathy in only 3% of diabetics with duration of 5 years, 20% with 6-10 years of duration and 34.3% with duration of more than 10 years in general diabet. population.

E M Kohner (1997) found that it is uncommon in IDDM to have retinopathy at the time of diagnosis of their disease while significant retinopathy was present in about 20% of NIDDM patients. In IDDM patients no retinopathy develops during first 5 years thereafter progresses rapidly and by 15 years it reaches 90%. In NIDDM over 20% cases had retinopathy during first 5 years of diabetes but their progression was slower.

In IDDM cases proliferative retinopathy develops in 60% cases in 20 years period while in NIDDM those cases treated with insulin 30% cases and without insulin treatment 20% cases develop retinopathy over 20 years (E M Kohner 1997).

DISTRIBUTION OF INTRAOCULAR PRESSURE

Table no. 6 shows in control group 152 (95%) eyes had tension below 22.4 mmHg and only 8 (5%) eyes had tension greater than 22.4 mmHg.

In diabetic group 146 (91.25%) eyes had tension less than 22.4 mmHg and 14 (8.75%) had tension greater than 22.4 mmHg. This shows that in diabetics greater no. of patients had raised tension (above 22.4 mmHg) than the control group. Intraocular pressures of both type 1
and II diabetic patients appear to be higher than in the nondiabetic population. (Traisman H.S. et al 1980). Studies have shown a higher prevalence of raised intraocular pressure in diabetic eyes is slightly higher than nondiabetics (Jain & Luthra, Becker B.1971, Klein BEK, Moss et al 1984).

But in control group maximum 58 (38.2%) eyes had tension 17.3 mmHg and 37 (24.3%) eyes had 18.9 mmHg while in diabetics maximum 66(46 normal +20 proliferative retinopathic) eyes had tension 17.3 mmHg and 35 (21.9%) eyes had tension 18.9 mmHg. The Baltimore eye survey found little evidence of an association between raised tension and diabetes. (Ophthalmology 102:40-53, 1995)

**MEAN INTRAOCULAR PRESSURE IN RELATION TO RETINAL STATUS**

The fact that mean intraocular pressure is definitely more in diabetics being 19.2 mmHg when compared to mean intraocular pressure in normal population 18.5 mmHg has been clearly demonstrated in our study from table no. 7. However various workers VIZ Palomar (1956) and Armaly and Baloglour (1967) observed low intraocular pressure in diabetics as compared to nondiabetics. Triasman et al (1980) found higher mean intraocular pressure in diabetic population as compared to nondiabetic population. Jain & Luthra 1964, Becker B. 1971, Moss et al 1984 found the same findings. Arora & Prasad (1989) like us have reported mean intraocular pressure in MODM to be 19.26 mmHg which is higher than normal mean intraocular pressure reported in general population i.e.16.1 mmHg (Becker & Schaffer). In our study the mean intraocular tension of patients with background diabetic retinopathy is more (19.75 mmHg) than mean intraocular pressure of normal population (18.5 mmHg) as well as eyes with diabetics without retinopathy 19.2 mmHg. But the eyes with proliferative retinopathy had mean intraocular tension (17.3 mmHg) less than normal population as well as diabetic population. The similar finding was reported by Bernard Becker (1971) that a highly significant increased prevalence of elevated intraocular pressure was found in diabetic subjects with no proliferative changes as compared to nondiabetic or diabetic individuals with proliferative retinopathy. The similar findings also reported by Arora & Prasad (1989) that the mean intraocular tension is greater in diabetic population as compared to nondiabetic population and also this rises up to background diabetic retinopathy but an interesting observation is that the mean. Intraocular
pressure again falls in eyes with proliferative retinopathy even falls below the tensions of nondiabetic population.

Mooney (1964) recently reviewed his diabetic patients and found that in his diabetic patients with unilateral glaucoma, diabetic retinopathy were present in non-glaucomatous eye only.

With all these observations we can conclude that high intraocular pressure has some influence in delaying or preventing the proliferative retinopathy changes in diabetic patients with glaucoma. In contrast to our findings Christiansons (1960) found a decreasing Schiotz tension as the grade of retinopathy increased.

INCIDENCE OF GLAUCOMA

In the present study it is evident from the table no. 8 that among 80 patients (160 eyes) 7 patients (14 eyes) 8.5% had glaucoma as compared to 4 patients (8 eyes) 5% in the control group. This shows that glaucoma is more common in diabetic population as compared to nondiabetics. Statistically (with Chi square test) the value is significant. According to Joslin’s (The eye and diabetics) frequency of glaucoma is 5% in the diabetic population as compared to 2% in the population at large. Goel et al (1970) found that higher (10.6%) incidence of glaucoma in early and established cases of diabetes compared to 1.4% in general population and similarly more incidence of diabetes in cases of glaucoma.

In Framingham eye study 2.7% cases were found to be having chronic glaucoma with diabetes mellitus. Baltimore eye survey found little evidence of an association between glaucoma and either type I or type II diabetes.

These above presented evidence suggest that the incidence of glaucoma in diabetes mellitus is appreciably increased over that in general population.

TYPES OF GLAUCOMA

As shown in table no. 9 in the study (diabetic group) among 7 (8.75%) of glaucoma patients 4 (5%) patients had primary open angle glaucoma, 2 (2.5%) cases had primary closed
angle glaucoma and 1(1.25%) had secondary (neovascular) glaucoma as compared to 2 (2.5%) , 2(2.5%) and 0 respectively in the control group.

So the primary open angle is more common in diabetic population as compared to normal population and also a compare to primary closed angle glaucoma in diabetic population.

Statistically (with Chi square test ) the value is significant . In 1950 Palmor said that cronic simple glaucoma did not occur more frequently in diabetic patients than general population.

In a Study conducted by Armstrong (1960) , R.K Daily, H I. Dobson and L. J. Girard who had proposed the incidence of various types of glaucoma as - primary noncongestive 4.1% , secondary 1.8% of total diabetic population.

In an epidemiological study conducted in Denmark (1983) the prevalence of glaucoma was as follows, primary open angle glaucoma was 9% secondary glaucoma was 2.1 %.

Although there is some disagreement among series cronic open angle glaucoma appears to be more prevalent among patients with diabetes . Armley (1967) Becker B. (1971).

Lieb et al (1967) and Davis (1980) also found higher prevalence of open angle glaucoma in diabetics . In our study primary closed angle glaucoma is equal 2(2.5%) ,2(2.5%) in both control and diabetic group respectively that shows no corelation with diabetes and primary closed angle glaucoma.

Becker (1960) wrote that there appeared to be no association between diabetics and closed angle glaucoma prevalence . Nielson (1983) confirmed the finding of Becker (1968) by a population study that there is no association between diabetics and closed angle glaucoma population.

In epidemiological study of Denmark (1983) prevalence rate of neovascular glaucoma was 2.13% - 21 3% in diabetics who were having proliferative retinopathy . In our study it is also evident that the control group had not any neovascular glaucoma where as in diabetic group 1 (1.25%) case had neovascular glaucoma . It means neovascular glaucoma is more common in diabetics as compared to normal population.
SEX DISTRIBUTION OF GLAUCOMA

As it shown in table no. 9 in this study the male:female ratio in primary open angle and primary closed angle glaucoma is 1:1 in each type of glaucoma respectively while in secondary glaucoma in diabetic group there was only one patient who was male. So that we could not make any statement upon the sex distribution among secondary glaucoma.

Hamman (1983) reported slight male preponderence in chronic open angle glaucoma. In the Framingham eye study open angle glaucoma was more frequent in males (Kini et al 1978).

Among whites, women are affected 3-4 times as often as men while amongst the American Blacks the sex incidence is reported to be equal (Alper M G. et al 1968).

In this study the no. of patients were not statistically significant (For sex distribution of every type of glaucoma). So we could not comment upon the sex distribution of the glaucoma in diabetes mellitus accurately but these are our observations.

AGE DISTRIBUTION OF GLAUCOMA

The primary open angle glaucoma occurs usually in 6-7 decades and closed angle occur somewhat earlier 5-6 decade (Neelsvestinalsen 1983). Kini et al Berngtson (1981), Martinez et al (1982) and Papvic (1982) noticed a higher frequency of glaucoma in diabetics in age group of 65-75 years and above.

In this study the maximum no. of glaucoma cases were found in fifth as well as in sixth and seventh decade in both early and late diabetics. This indicates that the glaucoma manifests earlier in diabetic population. These results are comparable with the study of Neelsvestinalsen (1983) to some extent.
FIELD DEFECTS IN GLAUCOMA PATIENTS

WITH DIABETES MELLITUS

In this study (table no. 11) among 7 glaucoma patients with diabetes 4 (57.14%) of glaucoma patients with diabetes had field defects. Among 4 patients (8 eyes) 2 patients had sickle shaped scotoma, 1 patient had arcuate type of scotoma and 1 patient of neovascular glaucoma had annular type of scotoma. In all these patients visual acuity was very poor.

Armly (1969) during followup of a group of patients with ocular hypertension discovered few patients who had field loss with abnormal glucose tolerance test.

However these field defects are not the real manifestations of glaucomatous damage in diabetic patients as some of the patients were also having cataractous and retinopathy changes along with glaucoma.

Secondly most of the patients in this study were illiterate so they would not co-operate very much in doing field charting. So by excluding all these things the results of field loss would have been different but these are our observations.

RELATIONSHIP BETWEEN I.O.P. & FIELD DEFECTS

Studies of diabetes mellitus with proven glaucoma cases indicate an increased susceptibility for progression of glaucoma damage at a lower intraocular pressure (Backer Shaffer).

The mean intraocular pressure in patients with field defects in diabetics was 24.6 mmHg. This result is comparable with the statement of Backer Shaffer (1971) because it is not very high intraocular pressure. But in control patients with glaucoma with field defects had mean intraocular pressure 24.4 mmHg which is similar to diabetic group. But these are our observation.