

OCULAR TENSION AND DIABETES MELLITUS*†

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MOST standard textbooks on ophthalmology make no reference to a relationship between ocular tension and diabetes mellitus but Newell (1965) refers to wide-angle glaucoma occurring more frequently in diabetics than in the normal population, and Sugar (1964) describes a greater incidence of chronic simple glaucoma among unselected diabetics than in the general population.

Waite and Beetham (1935) reported an incidence of 0.5 per cent. of "clinical glaucoma" in a study of 2,002 diabetics. Sunde (1951) pointed out that general arterial disease and other cardiovascular diseases often occurred in patients with chronic simple glaucoma but that the incidence was no higher than was consistent with their age.

Palomar (1956), in an extensive review of the ocular manifestations of diabetes mellitus, stated that chronic simple glaucoma did not occur more frequently in diabetes mellitus than in the general population, and noted that routine tonometry gave a lower than average tension in diabetics.

Armstrong, Daily, Dobson, and Girard (1960) investigated the frequency of glaucoma in diabetics and recorded an incidence of 1.8 per cent. of secondary glaucoma and 4.1 per cent. of chronic simple glaucoma, which is two to three times the incidence of chronic simple glaucoma reported in most population studies.

Cristiansson (1965) described the course of chronic simple glaucoma in diabetics and said that in regulating ocular tension attention should primarily be paid to the control of the diabetes. He also stated: "the diabetic eye has a somewhat higher tension than the normal eye".

Kojima, Niimi, Okajima, Suzuki, and Kanie (1965) studied the relationship between blood sugar level and ocular tension in diabetics and found an inverse correlation between sugar levels and ocular tension after 180 minutes of the glucose tolerance test.

An opportunity to study the correlation between ocular tension, glycosuria, and diabetes was provided by population surveys at present in progress in Bedford.

A Diabetes Survey has been carried out there since 1962 by a team of workers from Guy's Hospital Department of Medicine, and since 1963 a Population Glaucoma Survey has been carried out by a team of workers from the Institute of Ophthalmology.

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These two surveys have been running concurrently and all persons screened for glaucoma bring with them to the clinic a post-prandial urine specimen in a polythene container provided by the clinic.

Method of Study and Population Survey

The combined screening for glaucoma and diabetes has been carried out so far on a population of 3,072 persons over 40 years of age. Attendance at the clinic is by appointment, and appointment cards are available in general practitioners' surgeries, in ophthalmic opticians' consulting rooms, and in public buildings. Local publicity for the glaucoma and diabetes screening is provided by local newspaper advertisements, handbills distributed through letter-boxes, and notices in public buildings.

On attendance at the Glaucoma Screening Clinic, a family history of glaucoma and an ophthalmological history with special inquiry for haloes are taken, and the women are asked the number of days since their last menstrual period where applicable. Examination consists of applanation tonometry, a mean of three consecutive readings for each eye being recorded, fundus examination with special reference to the optic discs, and a routine urine test for glycosuria (using the Clinistix test). Details of the ophthalmological investigations have been published by Perkins (1964) and Wright (1966), and Sharp, Butterfield, and Keen (1964) have published details of the diabetic survey.

Results

Of the 3,072 persons screened, 212 (6.8 per cent.) had glycosuria, but eighteen of them failed to attend for a glucose tolerance test.

In this study a diagnosis of diabetes mellitus was made if the blood sugar level was 140 mg./100 ml. or more 2 hours after taking 50 g. glucose by mouth. 51 persons, including fifteen previously-known diabetics, fell into this category. Sixteen persons with a blood sugar level of 120 to 139 mg./100 ml. 2 hours after taking 50 g. glucose by mouth were diagnosed as prediabetics or "borderline" diabetics.

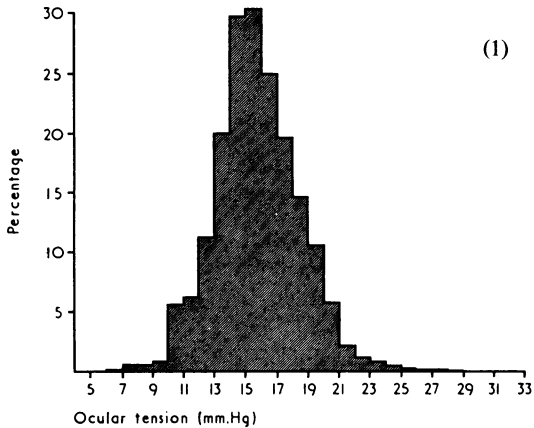
The non-diabetic group comprised the 127 persons who had no glycosuria, or in whom blood sugar level was below 120 mg./100 ml. 2 hours after taking 50 g. glucose by mouth.

These results are summarized in the Table.

TABLE I
RESULTS OF INQUIRY

Total Population	Glycosuria	Diagnosis	Blood Sugar Level (mg./ml.)
3,072	Absent 2,860	Diabetic 51 Pre-diabetic 16 Non-diabetic 127 Not tested 18	140 or above 120-139 119 or below
	Present 212		

Fig. 1 (opposite) shows the percentage distribution of ocular tension in a random population of 3,000 people in Bedford (5,993 eyes). The mean ocular tension for this random population is 15.73 mm. Hg (standard deviation ± 3.44) and the incidence of glaucoma 1.1 per cent.

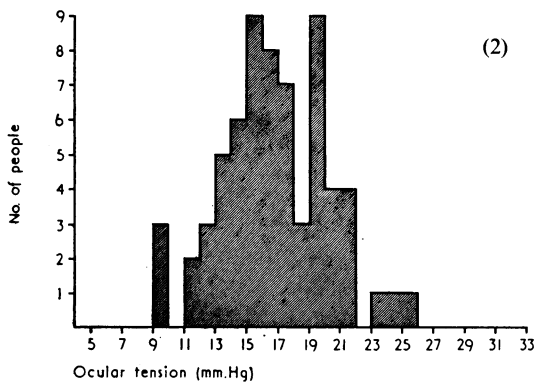


(1)

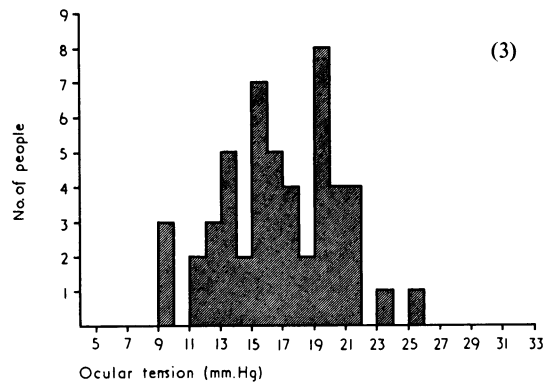
FIG. 1.—Percentage distribution of ocular tension in a random population of 3,000 people in Bedford.

FIG. 2.—Distribution of ocular tension in 67 diabetics and prediabetics.

FIG. 3.—Distribution of ocular tension in 51 diabetics.



(2)



(3)

Fig. 2 shows the distribution in the group of 67 diabetics and prediabetics. The mean ocular tension for this group is 16.76 mm. Hg (Standard Deviation ± 3.02). Three had ocular tensions of 23, 24, and 25 mm. Hg respectively, but none of them showed excavation of the optic discs or visual field defects and they were classified as ocular hypertensive. None of the 67 members of this group had established glaucoma.

Fig. 3 shows the distribution of ocular tension in the group of 51 diabetics. The mean ocular tension for this group was 16.61 mm. Hg (Standard Deviation ± 3.62). Two had ocular tensions of 23 and 25 mm. Hg respectively, but neither of them showed any other evidence of glaucoma. None of the 51 members had established glaucoma.

Blood sugar levels 2 hours after taking 50 g. glucose by mouth were plotted against the ocular tensions for each of the 194 persons with glycosuria (Fig. 4, overleaf). In four the blood sugar levels were above 300 mg./100 ml. and in one the level was 442 mg./100 ml. Two had levels of 40 and 36 mg./100 ml. respectively. Thirteen had ocular tensions of 21 mm. Hg and above, but none of these had any other evidence of glaucoma. Only one of the 212 with glycosuria had established glaucoma, and he failed to attend for a glucose tolerance test.

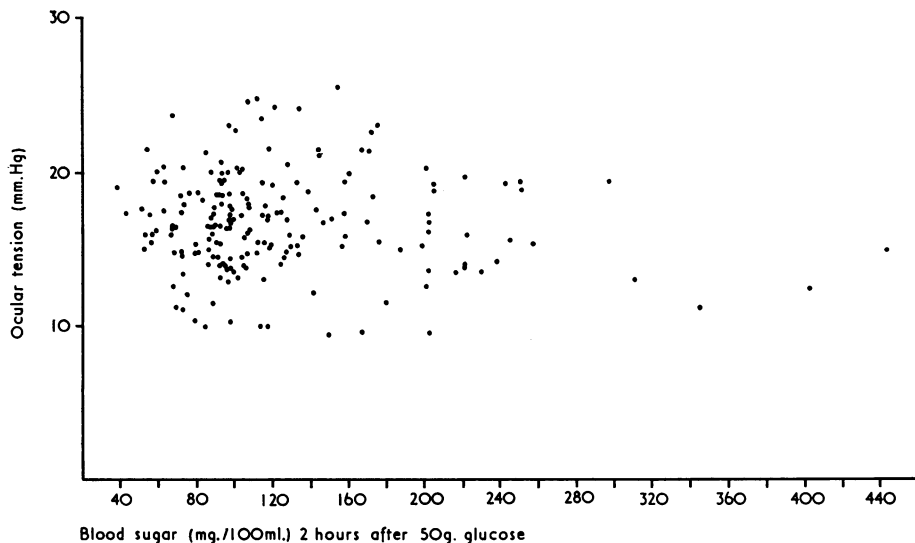


FIG. 4.—Ocular tension and blood sugar level 2 hours after taking 50 g. glucose by mouth in 194 persons with glycosuria.

Discussion

The ocular tensions in diabetics alone and in diabetics combined with the pre-diabetic group showed no significant difference from those of a random population study. From this it can be concluded that the ocular tensions of diabetics and prediabetics do not differ significantly from those of a sample population from the same area. In addition, the blood sugar level 2 hours after taking 50 g. glucose by mouth showed no correlation with ocular tension in a group of 194 persons, which included 127 non-diabetics, 51 diabetics, and 16 prediabetics.

These results are in general agreement with those of Palomar (1956) and Waite and Beetham (1935), in that the incidence of glaucoma in diabetics was no higher than that in the general population. Conversely these results do not agree with those of Armstrong and others (1960), who found the incidence of chronic simple glaucoma to be two to three times higher in diabetics than in the general population.

Summary

The ocular tension in diabetics and prediabetics in a population survey in Bedford was not significantly different from that in the general population. Blood sugar levels in 194 persons with glycosuria after taking 50 g. glucose showed no correlation with mean ocular tension and it is concluded that there is no increased incidence of glaucoma in diabetics.

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