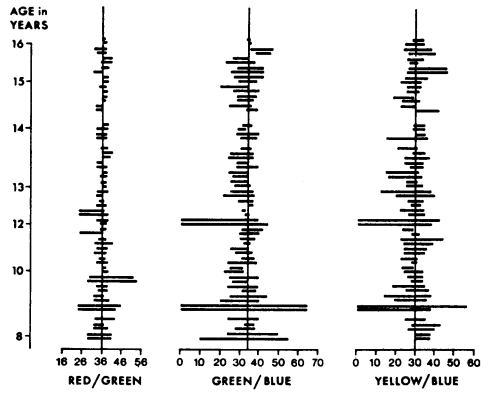

Fig 5 *Pickford Nicholson anomaloscope results showing variability of mid-matching point and range in relation to age*

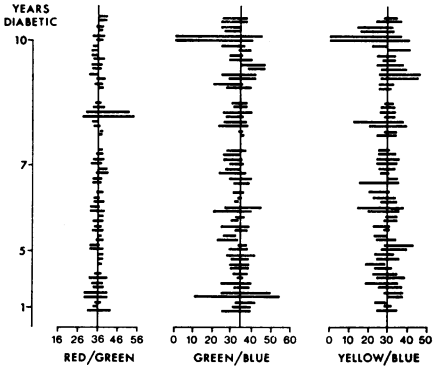

Fig 6 *Pickford Nicholson anomaloscope results showing variability of mid-matching point and range in relation to duration of diabetes*

A high incidence of acquired colour defect, especially in the yellow/blue equation, was reported by Francois & Verriest (1961) and Cox (1960). In 1966 Kinnear reported that adult diabetics without recognizable retinopathy showed a high incidence of defective colour vision and Lakowski (1968*a*) suggested that deterioration in colour discrimination may be detectable before retinopathy becomes visible, especially in the green/blue colour equation.

In our study of 60 diabetic children we have, so far, been unable to demonstrate any deterioration in visual function, but believe that we are in a strong position to establish each child's visual ability as a base-line from which to detect the earliest deterioration and to establish whether this precedes development of visible retinopathy.

Acknowledgment: We wish to thank Professor W S Foulds who advised on the colour vision studies and the analysis of results.

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Vessel Measurements in Diabetic Fundi

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Since the introduction of the light coagulator and its use in the treatment of diabetic retinopathy, a great deal of debate has centred on its respective merits in the treatment of proliferative and exudative diabetic retinopathy. This present study arose from a belief that the calibre of vessels and, in particular, that of the retinal veins was an important sign in early diabetic retinopathy.

It was felt that venous calibre could be used as an index of the severity of the disease and that such an index could be used to measure the success or failure of coagulation therapy.

A number of classifications for diabetic retinopathy exist (Ballantyne & Michaelson 1947, Scott 1951, Lee *et al.* 1966). Although these differ in detail, all are agreed that the important sign, at least in the preretinopathic stage, is a uniform distension or turgescence of the large veins and their main branches. It is widely accepted that the normal venous-arteriolar ratio is 3 : 2. The uniform distension or turgescence of the larger veins was first noted by Mylius (1937) who noticed that the venous-arteriolar ratio was commonly increased to 4 : 2 in diabetic fundi and this ratio has been confirmed in many diabetics by other observers (Ballantyne & Michaelson 1947, Croom & Scott 1949). These observations were, however, based on ophthalmoscopic examination and therefore presumably open to a large degree of observer error.

The general incidence of diabetes mellitus is high and most studies suggest that 1·4–1·7% of the population of the Western world are affected by the disease (Joslin *et al.* 1952). It occurs particularly in people in the fifth and sixth decades of life;

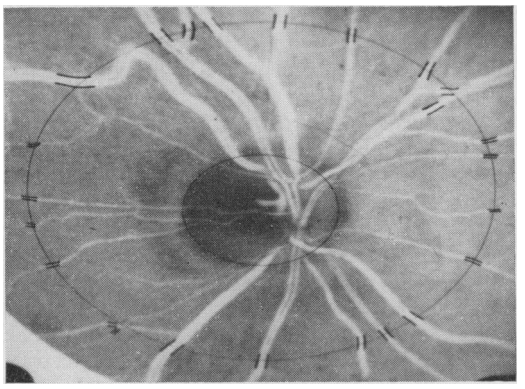

Fig 1 *Fundus negative projection on Zeiss 'Documentator' for vessel measurement*

50% of cases appear between the ages of 40 and 50 years, only 5% in the first decade and 3% in the eighth. It is widely accepted that the reported incidence of diabetic retinopathy in diabetes mellitus depends on several factors, the more important perhaps being the age of onset of the diabetes, the control of the glycosuria and the duration of diabetes.

In this study, the fundus photographic negatives of all diabetics who had attended the Department over the past five years were examined. These negatives were all taken with the Zeiss fundus camera using a Contax body and were of standard magnification (×1). In most cases each subject had had both fundi photographed and in all cases the 'best' negative was selected for examination, not randomly or on the basis of laterality as one would have hoped, but simply on the basis of best quality in terms of photographic grain, contrast, &c. These negatives were then studied on a Zeiss 35 mm 'Documentator', each negative being studied at a magnification of × 17·5. Fig 1 shows how the negatives were centred in such a way that the optic disc was seen to fit within a circle of 7·6 cm diameter drawn on the screen. Some discs were obviously smaller than the circle at this magnification and some were larger but all were felt to be within acceptable limits. A further circle three times the radius of the inner circle was drawn on the screen, so that the vessels were crossing the outer circle at approximately 1 disc diameter from the disc margin. An attempt was then made to measure the diameter of all vessels, both arteries and veins, at right angles to the point at which they crossed the outer circle. These measurements were made with a micrometer screw caliper.

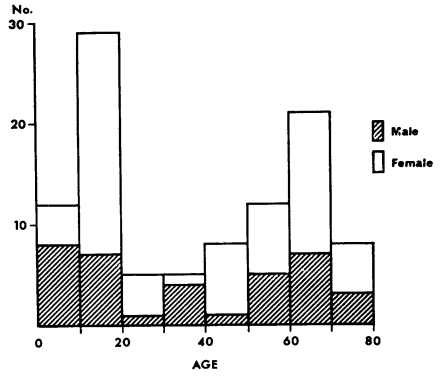

Fig 2 *Distribution by age and sex of population studied*

Ideally, one should attempt to compare an artery and a vein of similar status, preferably from the same quadrant. The selection of comparable vessels is notoriously unreliable even on retinal photographs, and for this reason the measurement of all vessels, both arteries and veins, was chosen in preference to the measurement of a few comparable vessels. It is well recognized that the mean value of a large number of crude measurements is usually more representative than that of a few accurate measurements.

A few of the difficulties met with in making these measurements are worth relating. In approximately one third of the negatives the quality was such as to make accurate vessel measurement impractical and these were discarded. Measurements were always made in a clockwise direction and each vessel was measured down to the nearest millimeter. Focus on such projections is critical, especially in measuring vessels of smaller diameter and in all cases the focus end-point was that at which photographic grain structure was sharp. Inevitably, some vessels were seen to divide at the point of measurement and in such cases the measurement was taken just prior to the point of division within the outer circle. Recurrent vessels were met with not infrequently; the recurrent segment of such vessels was not measured.

Another major problem in this study, and this may only apply to black and white negatives, was the difficulty of distinguishing arteries from veins. This was a major difficulty and some negatives had to be rejected on this basis. In almost all negatives, small retinal vessels were seen to cross the disc margin but these had disappeared before reaching the outer circle and they were not measured.

Results

One hundred negatives were available for vessel measurement. Fig 2 shows the distribution by age and sex of the population under consideration. It can be seen that although the mean age of the population studied was 36·7 years (male 36, female 37·2) the population readily divided itself into a very much younger group, most being between 10 and

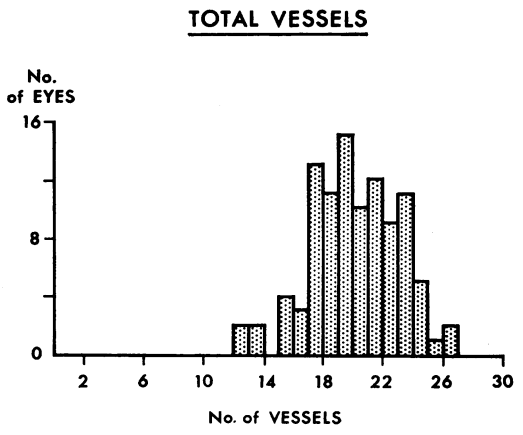

Fig 3 *Distribution of all vessels measured, one disc diameter from disc margin*

19 years, and an older group, most being between 60 and 69 years. This is a very different distribution from that of the normal diabetic population previously mentioned and proved to be rather fortuitous as further study showed them to be, by and large, the juvenile early-onset insulin-dependent diabetics and the mature late-onset diabetics who are generally independent of insulin and could be controlled on diet and/or an oral hypoglycæmic agent.

Obvious questions immediately spring to mind. Do the older diabetics differ from the younger in terms of vessel measurement? Is there any sex difference? Calculations were based on the number of vessels crossing the outer circle at one disc diameter from the disc margin, distinguishing between arteries and veins. The aggregate widths for both types of vessels were established. The mean width for the respective vessel type was calculated accordingly, as was the ratio of the mean venous diameter to the mean arteriolar diameter.

Fig 3 shows the distribution of both arterioles and venules as they cross the outer circle, one disc diameter from the disc margin. Not surprisingly, this is essentially binomial in form and no obvious discrepancy is apparent. The mean number of arteries present was 10·02, while the mean number of veins present was 10·59. There was no significant difference on the basis of age or sex.

With regard to previous observations, one might reasonably expect there to be a significant variation in vessel calibre, especially in venous diameter, and one might expect this to vary, certainly with age in relation to the duration of the disease. Table 1 shows the variation of the aggregate diameter of veins by age for the whole population. Surprisingly, a study of this table shows no significant difference between the various groups. Indeed, there is an obvious similarity in mean venous widths between the juvenile insulin-dependent diabetics and the mature insulin-independent diabetics.

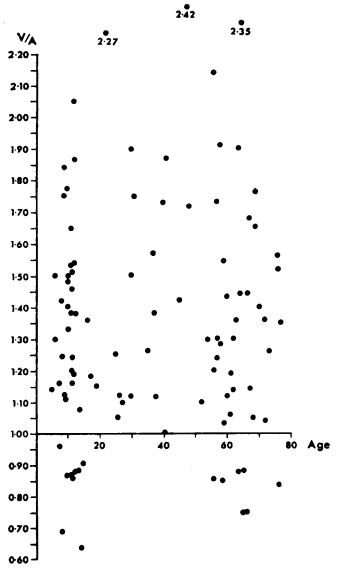

Fig 4 *Scattergram of venous-arteriolar ratios found, based on mean vessel widths*

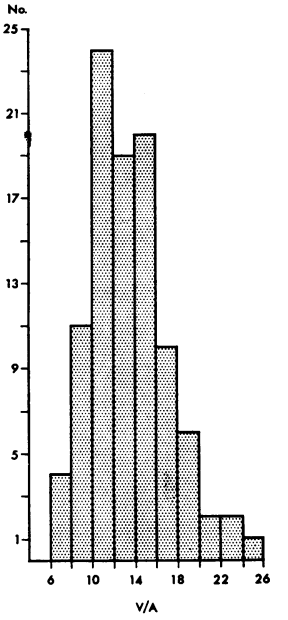

Fig 5 *Distribution of venous-arteriolar ratios found*

Fig 4 is a scattergram of the venous-arteriolar ratio in the study based on mean vessel width. From this it can be seen that the variation is very large. The mean was 1·33 : 1 or 2·66 : 2. This is very much less than the venous-arteriolar ratio of 4 : 2 which is widely quoted in diabetic retinopathy, and varies little from the accepted 3 : 2 ratio in the normal population. Fig 5 is a distribution curve based again on the venous-arteriolar ratios and it is interesting to note that the distribution appears to be binomial with perhaps a slight skew to the right. There would therefore appear to be little difference in the venous-arteriolar ratios between this diabetic population and that which one would expect in a normal population.

Table 1
Variation of the aggregate diameter of veins by age for the whole population

Age (years)	*Mean aggregate venous width (mm)*	*No. of eyes*
1–9	30·4	12
10–19	31·4	29
20–29	39·4	5
30–39	29·4	8
40–49	34·0	5
50–59	30·6	12
60–69	32·9	21
70–79	31·0	8

Another question worth considering was whether or not there was any association between the duration of the disease and the venous calibre. Unfortunately, such detail was not always available and it was possible to obtain reasonably accurate information on only 51 persons. In this study no real association between the years affected and venous diameter was noted and there was no obvious difference in the mean venous calibre between the juvenile insulin-dependent diabetics of whatever standing and the mature, generally insulin-independent, diabetics. There would therefore appear to be no difference between the venous diameters of young juvenile diabetics and old mature diabetics, certainly on the basis of this small, highly selected population. Similarly, in this study the venous-arteriolar ratio would appear to differ but little from that which one would expect to find in a normal population. This, of course, appears to differ considerably from previous observations. The study itself can be criticized on a number of counts, the most important being that of the selection of the population. A normal population has not been similarly studied as yet and no inter- or intra-observer studies have been carried out. It is none the less surprising that obvious differences did not occur between the young and old diabetics and that the venous-arteriolar ratio differed little from that expected in a normal population.

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A New Look at the Ocular Side-effects of Long-term Systemic Corticosteroid and Adrenocorticotrophic Therapy [*Abridged*]

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Four aspects of systemic corticosteroid and corticotrophic hormone therapy are discussed: steroid (posterior subcapsular) cataracts, steroid glaucoma, serous exudates and sudden withdrawal phenomena. The first three have all been reported before (Black *et al.* 1960, Crews 1963, Alfano 1963, Jain & Kapalmit 1966, Williamson & Dalakos 1967, Williamson *et al.* 1969) but the last does not appear to have been documented.

A group of 356 patients studied in the Centre for Rheumatic Diseases and the University Eye Department, Western Infirmary, Glasgow, was recorded by Williamson *et al.* (1969). However, a new look at these patients brings out some interesting features. Twenty per cent of patients treated with over 15 mg prednisolone per day or its equivalent for between two and eight years will develop steroid cataracts. Only 5% of patients who receive less than 15 mg per day will develop posterior subcapsular opacities. Once developed, the opacities progress slowly and it is quite safe to continue with the same dosage of steroid until the opacities reach Grade III (Crews 1963). Beyond this level, increasing difficulty with vision will result and once the opacities are Grade IV, extending into the cortex, the likelihood is that they will progress relentlessly despite cessation of steroid therapy. Systemic steroid glaucoma is extremely rare.

Macular exudates are described in three patients; two were receiving adrenocorticotrophic hormone (Acthar Gel) 20 i.u. per day intramuscularly for over two years, and one was receiving excessive doses of depot tetracosactrin (Synacthen Depot) as a result of a misunderstan-