Diabetic retinopathy and its relation to type of diabetes: review of a retinal clinic population

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SUMMARY A detailed survey was performed of 100 consecutive diabetic patients with severe retinopathy referred to a retinal clinic. They were classified as having either type 1 (insulin-dependent) or type 2 (noninsulin-dependent) diabetes. There were significant associations between type 1 diabetes and an initial diagnosis of proliferative retinopathy and between type 2 diabetes and an initial diagnosis of maculopathy. There was a significant association between male sex and proliferative retinopathy. Referral patterns to this clinic and the medical supervision of the patients are discussed.

The increasing recognition and provision of facilities for treating diabetic retinopathy in specialist centres have led to an expansion in the ophthalmological workload. While attention has focused on the treatment of established lesions with photo-coagulation, emphasis should be placed on their prevention through the optimisation of blood glucose levels over prolonged periods of time. Evidence continues to accumulate that poor glycaemic control is the most important factor in the aetiology of diabetic retinopathy.¹²

Previous studies of the natural history of diabetic retinopathy and the grading of lesions have failed to take into consideration the clinicopathogenic heterogeneity of the diabetic syndromes. For example, the familiar textbook classification of diabetes into ‘juvenile-onset’ and ‘maturity-onset’ has now been largely abandoned by diabetologists. The currently used classification in the UK, which has also been adopted by the American Diabetic Association and the World Health Organisation,³ divides the majority of diabetic patients into 2 groups: type 1 (insulin-dependent) and type 2 (noninsulin-dependent). Abundant evidence shows that these 2 polar forms of diabetes have a separate aetiological pathogenesis.⁴⁵ The majority of type 1 diabetic patients develop the disease in childhood or adolescence, but it is by no means confined to this age group. Similar genetic and immunological features can be found in late-onset insulin-dependent cases. In contrast, type 2 diabetes does not seem to be due to an immune-mediated destruction of islet B cells. Although predominantly presenting in adult life, it is sometimes seen in young people. The aetiology of this type of disease remains largely unknown. Frequently patients with type 2 diabetes are treated with insulin to obtain better metabolic control. Thus, ‘insulin-treated’ patients are not necessarily insulin-dependent, and this should be borne in mind when classifying a group of patients according to their type of disease.

Kohner has suggested that there is an association between proliferative retinopathy and ‘juvenile onset’ diabetes and between diabetic maculopathy and ‘maturity onset’ diabetes.⁷ Sorsby found a higher incidence rate of blindness due to diabetes in the 15–29 and 30–49 age groups in males than in females.⁸ Caird et al. denied there was any association between sex and retinopathy, though their data from the Radcliffe Infirmary Diabetic Clinic show a male:female ratio of 51:25 in diabetic patients with retinopathy in the 10–29 age group.⁹

More recently Deckert et al.¹⁰ suggested that male type 1 diabetic patients have a worse prognosis than females, and our own studies have shown a definite association between male sex and proliferative retinopathy in type 1 diabetes.¹¹ A recent study of reports of type 1 diabetic patients with severe...
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Diabetic retinopathy and microvascular disease, including both proliferative retinopathy and diabetic nephropathy, supported this association.  

This paper presents the results of a survey of consecutive diabetic patients with retinopathy referred to a specialist retinal clinic and examines the relationship between the type of retinal lesion and the type of diabetes. Referral patterns and the medical supervision of the patients were assessed.

Subjects and methods

The study was based on diabetic patients referred to the retinal clinic at St Bartholomew's Hospital. They were classified as having either type 1 (insulin-dependent) or type 2 (noninsulin-dependent) diabetes according to the following features of their clinical history: insulin dependence or independence, age at onset, history of ketosis, body weight at diagnosis, and familial type of diabetes. Those patients with either lens opacities or only minimal background retinopathy—that is, less than 5 microaneurysms and without macular involvement or retinal oedema—were excluded. The resultant 100 consecutive patients with severe retinopathy were considered in the analysis.

The retinæ were examined by a consultant ophthalmologist (R.A.F.W. or J.H.D.) by direct and indirect ophthalmoscopy, colour photography, and in most cases fluorescein angiography. The subjects were then classified according to their retinal diagnosis at initial presentation to our clinic or to the referring ophthalmologist as having (a) proliferative retinopathy, (b) diabetic maculopathy, or (c) severe widespread background diabetic retinopathy. One case was found to have a disciform degeneration as the cause of severe visual loss. The current age, age at diagnoses of diabetes and retinopathy, known duration of diabetes, and interval between the diagnoses of diabetes and retinopathy were noted in each subject. They were asked about the frequency of home testing of urine or blood for glucose and about the frequency and type of medical follow-up. The source of referral to the clinic was recorded.

Table 1 Mean age, age at diagnosis of diabetes, and known duration of diabetes

<table>
<thead>
<tr>
<th></th>
<th>Type 1 diabetes (n=57)</th>
<th>Type 2 diabetes (n=43)</th>
</tr>
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<tbody>
<tr>
<td>Current age</td>
<td>45±13 (21–73)</td>
<td>62±8 (43–81)</td>
</tr>
<tr>
<td>Age at diagnosis of</td>
<td>203±13 (1–49)</td>
<td>51±11 (27–79)</td>
</tr>
<tr>
<td>diabetes</td>
<td></td>
<td></td>
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<tr>
<td>Known duration of</td>
<td>25±9 (9–49)</td>
<td>11±8 (2–26)</td>
</tr>
<tr>
<td>diabetes</td>
<td></td>
<td></td>
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</tbody>
</table>

Results expressed in years as mean±SD (range).

and type 2 (noninsulin-dependent) diabetes. Of the latter group 9 had failed to obtain adequate control on their initial treatment with diet or oral hypoglycaemic agents and subsequently were receiving insulin.

There was an excess of males in the type 1 diabetic patients (M:F=41:16) in contrast with the equal sex ratio in the type 2 diabetic patients (M:F=22:21), though this difference was not statistically significant ($\chi^2$ with Yates's correction 3.69, p=0.055).

There was a strongly significant association between type 1 diabetes and proliferative retinopathy and type 2 diabetes and diabetic maculopathy (corrected $\chi^2$ 24.5, p<0.00001), as shown in Table 2. In addition Table 3 shows the significant association found between male sex and proliferative retinopathy ($\chi^2=7.54$, p=0.0118).

Table 4 shows the known duration of diabetes at the initial presentation with retinopathy. The subjects with type 2 diabetes had a shorter known duration of diabetes at the onset of retinopathy than those with type 1 diabetes, whether considered as a whole (p=0.0001), with proliferative retinopathy (p=0.0001), or with maculopathy (p=0.02, Student’s t test). The difference for severe background retinopathy was not significant. Within the 2 diabetic groups the differences in the intervals before retinopathy for the 3 retinal diagnoses were not statistically significant.

The age at diagnosis of retinopathy is shown in

Table 2 Relationship of retinal diagnosis to type of diabetes

<table>
<thead>
<tr>
<th></th>
<th>Number of patients</th>
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<tbody>
<tr>
<td></td>
<td>Type 1 diabetes</td>
</tr>
<tr>
<td>Proliferative retinopathy</td>
<td>44</td>
</tr>
<tr>
<td>Maculopathy</td>
<td>7</td>
</tr>
<tr>
<td>Severe background</td>
<td>6</td>
</tr>
<tr>
<td>retinopathy</td>
<td></td>
</tr>
<tr>
<td>Disciform degeneration</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>57</td>
</tr>
</tbody>
</table>

$\chi^2=24.5$, p<0.00001.
physician. Eighteen (10 insulin-dependent, 8 non-insulin-dependent) were not receiving any supervision of their diabetes despite severe retinopathy threatening their sight. Reasons given for this lack of supervision included having been discharged from a diabetic clinic, believing that medical supervision was no longer necessary, and dissatisfaction with the diabetic clinic either due to a long waiting time or seeing a different doctor on each occasion.

**Discussion**

Surprisingly, there is virtually no documented evidence on the association between the major forms of diabetic retinopathy with the type of diabetes. The present results confirm that proliferative retinopathy is significantly associated with type 1 diabetes and diabetic maculopathy with type 2 diabetes. Type 1 diabetes usually but not always presents at a younger age than type 2 diabetes, and thus the patients with type 1 diabetes had a lower age of onset of diabetes and of retinopathy than those with type 2 diabetes. The reason for this segregation of retinal lesion with type of diabetic syndrome is unknown. If hyperglycaemia is the common factor leading to retinopathy, it would be expected that the type of diabetes would be irrelevant.

It is possible that the excursions in blood glucose level are wider and more erratic in type 1 than in type 2 diabetes, and this together with other more severe metabolic deviations may influence the retinal pathology. However, the older age of the patients with type 2 diabetes may itself be important, as macular disease in general is more common in the older age group. The study also showed that proliferative and macular lesions may each occur in both major forms of diabetes. Indeed in the case of localised macular disease new vessels may arise later, or the background changes may become more widespread and severe.

This study confirms the association between male sex and proliferative retinopathy in type 1 diabetes.11 Children with type 1 diabetes show a slight but definite male preponderance,13 but why male patients tend to fare more badly is not clear. Hormonal, genetic, social, or psychological factors may contribute to this increased risk. This sex difference may have been masked in previous studies when patients with different types of disease were considered together. The majority of diabetic patients have the type 2 variety, and in this older group females predominate. This may account for the excess of females among the registered blind.

The duration of diabetes at the presentation with retinopathy was longer in the patients with type 1
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Diabetic retinopathy and its relation to type of diabetes. This difference may be artificial to some extent, as the type 2 diabetic patients probably had undetected hyperglycaemia for longer than their known duration of disease. It is of interest that the duration of diabetes at the presentation with retinopathy was not significantly affected by the type of retinal diagnosis within each group. Thus proliferative retinopathy does not appear earlier in the course of the disease than maculopathy. Factors in the individual patient must determine which retinal lesion develops.

It is disturbing that 18% of these patients were receiving no medical supervision of their diabetes, and 15% were not assessing their diabetic control.

In conclusion we suggest that close co-operation between the diabetic patient and physician may minimise the risk of complications, and co-operation between the physician and ophthalmologist may prevent their progression.

References

10 Deckert T, Poulsen JF, Larsen M. Prognosis of diabetics with diabetes onset before the age of thirty-one: survival, causes of death and complications. Diabetologia 1978; 14: 363–70.