White spots in the central fundus in diabetic children and adolescents

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Abstract. Previously, small defects in the retinal pigment epithelium appearing as depigmented spots in the fundus photographs have been observed in a high proportion of adult diabetic patients. In order to evaluate whether these changes already occur in children we examined the black-and-white and colour fundus photographs of 206 diabetic children aged 4.6-19.6 years (median 12.6), with the median duration of diabetes of 4.7 years (range 0.0-14.2). Early signs of retinopathy were observed in 27 (13.1%) of them. The control group was composed of 45 healthy children aged 8.1-16.6 years (median 11.8). One or more tiny white spots in the fundus of one or both eyes were observed in 97 diabetics (47.1%), more often in those with retinopathy than in those without (66.7% vs. 44.1%, p<0.001). In the control group similar spots were observed in 24 children (53.5%). Only in a small proportion of children (4.4% of both diabetic and control patients) were the spots numerous. In children most of the white spots in the fundus may represent drusen type deposits rather than defects in the pigment epithelium.

Keywords: diabetes - retinopathy - pigment epithelium - prevalence.

Defects in the retinal pigment epithelium (PE), defined as depigmented spots on colour photographs and hyperfluorescent areas on fluorescein angiograms, have been observed in 23-31% of healthy adult subjects (Nielsen 1982; Algvere et al. 1985). In diabetics, similar PE changes have been reported in 53% before the age of 50 years and in 70% after 50 years of age (Jerneld & Algvere 1984). It has been suggested that even minimal pathology in glucose metabolism (decreased oral glucose tolerance test) may precipitate PE changes at an earlier age (Algvere et al. 1985). Palmberg et al. (1981) reported that angiography revealed at least one PE defect in 85% of juvenile onset white diabetics. In this study we wanted to evaluate whether PE lesions visible on black-and-white and colour photographs were already present in diabetic children.

Patients and Methods

The fundi of 206 diabetic children, 83.7% of all diabetics followed up at the Department of Pediatrics, Oulu University, were photographed. There were 116 boys (56.3%) and 90 girls (43.7%) with the mean age of 12.2 years (median 12.6, range 4.6-19.6). The median duration of diabetes was 4.7 years (range 0.0-14.2), 95 patients (46.3%) had had diabetes for 5 years or more.

The fundi were photographed after dilatation of the pupils with 1% cyclopentolate drops using Canon CF-60Z camera and a field of 60° centered at the fovea centralis. The black-and-white negatives were developed into 18 x 24 cm paper prints and the colour slides were viewed 24 times magnified by projector and on light table with a +20D lens. In order to avoid interpretation of any photographic artefacts as fundus changes, the fundus finding was considered positive only when the same lesion was observed in both the black-and-white and the colour photograph. In 41 of the 206 diabetic patients only one technically good photograph was available.
Diabetic retinopathy changes were recorded using a simplified grading protocol and the standard photographs used by the Kroc Collaborative Study Group (Davis et al. 1985). In addition, white spots seen on both the black-and-white and colour photograph were recorded.

In a few cases follow-up photographs taken 1-2 years later as well as fluorescein angiograms were available for comparison.

The control group comprised 45 healthy children with the mean age of 11.7 years (median 11.8, range 8.1-16.6) referred to the outpatient clinic.
Fig. 2.
Black-and-white photograph of the left fundus of a 13-year-old diabetic boy showing groups of white spots in the macular area. No signs of retinopathy were observed.

Fig. 3.
Black-and-white photograph of the left eye of an 11-year-old healthy girl showing groups of white spots temporal to the macula.
The association between the presence of fundus changes and various demographic factors, such as age and duration of diabetes, was determined by simple and multiple regression analysis. Chi-squared test was used for comparison of the occurrence of white spots in the diabetic patients and the control group, and between diabetics with and without retinopathy.

Results

Signs of diabetic retinopathy were found in 27 diabetic patients (13.1%). None of them had proliferative retinopathy.

Tiny white spots visible on both the black-and-white and the colour photograph were observed in 97 diabetic patients (47.1%). The spots were more common in diabetics with retinopathy than in those without (66.7% vs. 44.1%, p < 0.001). There was also a positive correlation with age (r = 0.232, p < 0.01) and the duration of diabetes (r = 0.229, p < 0.001). Multiple regression analysis showed that the occurrence of the white spots and duration of diabetes were related even when age was taken into account (p > 0.05). In the control group similar spots were observed in 24 children (53.5%), and they did not correlate with age.

In most eyes the number of spots in the photographic field varied between 1 and 4 per eye. Only 9 diabetic patients (4.4%) and 2 control subjects (4.4%) were found to have either numerous solitary white spots (Fig. 1) or groups of yellowish-white spots (Figs. 2 and 3), mainly in the macular and/or paramacular area. The spots were either uni- or bilateral. Three of the 9 diabetic patients had signs of early retinopathy (Fig. 1), in 6 patients both fundi were otherwise normal (Fig. 2).

In order to examine the nature of the solitary white spots, contact lens examination and/or fluorescein angiography of the fundus were performed in some cases. The spots seemed to be deep to the retina, and they could not be visualized in the angiograms studied (Fig. 1); they were neither hyper- nor hypofluorescent, and no leakage was observed in their vicinity. Control photographs after 1-2 years' follow-up showed that most of the spots had remained unchanged, a few had disappeared, and some new spots had developed (Fig. 1).

In 4 diabetic patients (Fig. 2) and one control patient (Fig. 3) the spots formed a group in or close to the macular area. All these were uniliocular. Based on contact lens examination these spots were at the level of PE and seemed to represent PE defects. Follow-up examination and photographs 1-2 years after the initial study showed no alteration in these changes.

Discussion

Tiny white solitary spots seem to be a very common occurrence in the ocular fundus. Nielsen (1985) found these elements in the colour photographs in 58% of 10-25-year-old healthy subjects. In the present study we observed them in 54% of the healthy and 47% of the diabetic children. The nature of the spots is not clear.

Comparison of the photographs with the fluorescein angiograms in some of our patients showed that the spots were not hyperfluorescent at the early phase of the angiogram. The lack of the typical window effect on the angiogram reveals that they did not correspond to pigment epithelial defects which have been reported in a great proportion of adult diabetics (Palmberg et al. 1981; Jerneld & Algvere et al. 1985). Without having done fluorescein angiography in all the cases, we cannot exclude the possibility that some of the solitary white spots were PE defects. However, sure PE defects in these young diabetics were rare.

Ophthalmoscopically and on the photographs the solitary spots did not resemble hard exudates, and no leakage in their vicinity was found in the angiograms studied. In addition, most of them were found in eyes without any signs of diabetic retinopathy. The solitary spots seemed to be long-standing. Control photographs showed that only a few spots had faded or disappeared during the follow-up period of 1-2 years, most of them were unchanged and some had developed. These findings speak in favour of drusen type deposits which may disappear slowly. Some of them may possibly result in PE defects with time. In the group of diabetics their occurrence increased with the presence of retinopathy, with age and with the duration of diabetes, in the control group correlation with age was not observed.

The prevalence of diabetic retinopathy in children in the literature varies considerably. It has been suggested that the high figures (31-75%)
presented by some authors based on angiography (Brooser et al. 1975; Malone et al. 1977; Hövener et al. 1980; Blanksma et al. 1983) could be due to 'overdiagnosis' by counting hyperfluorescent spots caused by PE defects in the prevalence of microangiopathy. According to our findings PE defects are, however, rare in young diabetics and therefore they may not explain the high prevalence rates of retinopathy presented.

In adult persons an increase in the minute changes in the retinal PE has been observed already in patients with abnormal glucose tolerance test (Algvere et al. 1985). Therefore it has been thought whether PE changes could be used as an early marker of diabetic retinopathy. According to the present study this is not the case in young diabetics. Tiny solitary white spots in the fundus were not significantly more common in the diabetic as compared to the control children, and also, sure PE defects seem to be rare in young diabetics. Therefore, the diagnostic or prognostic value of the white spots in the evaluation of diabetic eye disease in children is limited, although the occurrence of the spots increased with the presence of retinopathy. Most of the tiny spots possibly represent drusen type deposits rather than PE defects.

References


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