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Review Articles

Photocoagulation Therapy of Proliferative Retinopathy in Young Onset Type 1 (Insulin-Dependent) Diabetes*

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Summary. Fifty-one young onset Type 1 (insulin-dependent) diabetic patients with proliferative diabetic retinopathy before the age of 25 years were treated over a 3 year period by xenon photocoagulation. A few were treated additionally by argon laser, cryo- or diathermy-coagulation. The results of therapy with respect to both fundus disease and visual acuity were highly dependent on the fundus changes at the beginning of photocoagulation. After 3 years, 65% of eyes with peripheral neovascularization alone did not develop any new vessels. In contrast, only 20% with disc new vessels did not develop further neovascularization. Vitreous haemorrhage further reduced this percentage. The presence of blindness 3 years after treatment was rare in eyes with peripheral neovascularization alone (3%). However, 52% of eyes with disc neovascularization and vitreous haemorrhages were blind 3 years later.

Key words: Proliferative retinopathy, Type 1 diabetes, photocoagulation.

The efficacy of photocoagulation in the treatment of diabetic retinopathy is now firmly established. Most impressive are those studies with unilateral treatment when diabetic changes were almost identical in both eyes [1–3]. These investigations also show that the effectiveness of treatment differs from patient to patient. Two factors seem to play an important role: the type and the extent of fundus changes and the age of the patient. In this context, several authors have indicated the poor prognosis of proliferative retinopathy in juvenile diabetic patients [4–6]. Proliferative retinopathy in these patients has been called florid retinopathy by some authors. This usually takes a rapid course without treatment and has been described as 'rapid, bloody and blinding' [7]. Besides photocoagulation for these patients, hypophysectomy has also been recommended [5, 6]. A systematic investigation of photocoagulation treatment in these patients has not yet been reported.

Patients and Modality of Treatment

Patients

Patients were selected for this study from the young onset Type 1 diabetic subjects attending our hospital who fullfilled the following criteria: (1) diagnosis of diabetes before 13 years of age; (2) occurrance of proliferative diabetic retinopathy before the age of 26 years; (3) duration of treatment and observation from the first coagulation: 3 years (range: 2 years 6 months – 3 years 4 months). Between 1968 and 1977, a total of 51 patients fullfilled these three criteria. In 30 patients, criteria 2 and 3 were fullfilled for both eyes, but in 21 patients they were fullfilled for one eye only. In these 21 patients, the other eye showed either no proliferative retinopathy (six patients), it occurred later (eight patients) or it was already so far advanced that photocoagulation treatment was no longer possible (seven patients). The study therefore relates to a total of 81 eyes. The mean age at the diagnosis of diabetes was 6.9 ± 3.4 years (mean ± SD, range: 2 months–12 years). The mean age at the diagnosis of proliferative retinopathy was 22.6 ± 2.3 years (mean ± SD, range: 16–25 years) and the mean duration of diabetes at the diagnosis of retinopathy was 15.7 ± 3.1 years. It is of interest that there were 35 females and only 15 males in the study.

Almost half of the patients were followed for longer than 3 years after the first photocoagulation, the maximum time being 9 years. Only data from patients studied for 3 years have been analysed.

Different Types of Proliferative Diabetic Retinopathy

The retinopathy was classified in accordance with the method of the Diabetic Retinopathy Study Research

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Group [2] into the following four types (Fig. 1): (I) peripheral proliferation only, (II) proliferation from the disc with or without peripheral proliferation, (III) peripheral proliferation with epi-retinal or intra-vitreal haemorrhages, (IV) proliferation from the disc and peripheral proliferations and epi-retinal or intravitreal haemorrhages. Grading was performed by three ophthalmologists. Fundus sketches and photography were performed for all eyes. Fluorescein angiography was not usually used for the grading of advanced stages of proliferative retinopathy. Out of 81 eyes, 31 had type I, 20 type II, nine type III and 21 type IV changes. Three years after the start of therapy, all eyes with localized traction-detachment were classified as types III or IV, because of intra-vitreal haemorrhages.

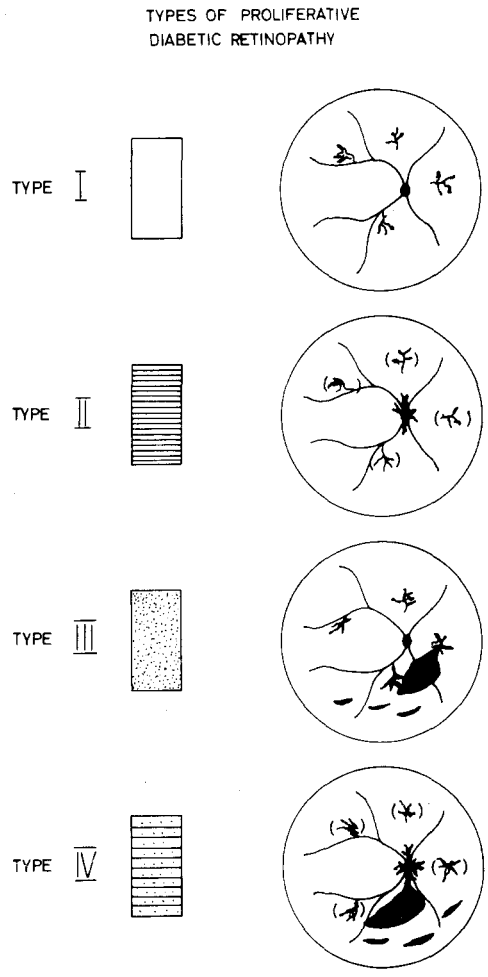

Fig. 1. Classification of proliferative diabetic retinopathy. Type I: peripheral proliferation only, type II: disc proliferation ± peripheral proliferation, type III: peripheral proliferation + epi-retinal or intravitreal haemorrhages, type IV: disc and peripheral proliferation + epi-retinal or intra-vitreal haemorrhages

Mode of Treatment

In 77% of treatments, xenon photocoagulation was performed, argon laser treatment in 3%, intrascleral diathermy in 13%, and transconjunctival and transscleral cryocoagulation in 7%. With few exceptions, several sessions of coagulation were required for each eye over 3 years. On average, 2.6. coagulation treatments were performed, of which 2.2 were performed in the first year, 0.3 in the second year and 0.1 in the third year.

In order to compare the different coagulation treatments, the surface of the coagulated retinal area was calculated. This calculation was derived from coagulation spots of 3° diameter (0.6 mm^2 in area). The average coagulation treatment in a single session for one eye was equivalent to 158 spots of 3° diameter. The mean (± SD) number of coagulations during the 3 years of treatment was 411 ± 191. The Mann Whitney U-test was used for statistical analysis.

Results

Retinal Morphology

The changes in fundus appearance at the end of 3 years treatment and observation are shown in Figure 2. It can be seen from this figure that of the 31 eyes with type I changes originally, 20 showed no further evidence of proliferation. Therefore, these may be re-classified as type 0, to which none of the eyes corresponded at the beginning of the study, because all eyes by definition had proliferation before treatment. Three eyes with type I changes developed disc proliferation and were re-classified as type II. Only two eyes deteriorated to type III or IV changes. Of the eyes with type II changes, eight eyes remained in the same group, with the continued presence of disc proliferation. Seven eyes improved to types 0 or I. In five eyes, haemorrhages occurred, causing a deterioration to type III or IV. With regard to the type III group with peripheral proliferation and intravitreal haemorrhages, five eyes improved to type 0 or I changes, three remained the same and only one eye became worse, deteriorating to type IV. In the eyes with type IV changes (which have the worst prognosis), nine out of 21 eyes improved after 3 years to types 0, I, II or III. Two eyes remained unchanged, but almost half of them developed additional proliferation and haemorrhages and some developed traction detachment and secondary glaucoma.

Visual Acuity

Figure 3 shows the changes in central visual acuity 3 years after the start of treatment. Each class of visual acuity may contain eyes of different fundus appearance as indicated by the symbols within the columns. Three years after the start of therapy, it can be seen that out of 81 eyes, 42 had a visual acuity between 0.4 and 1.0 and 17 between 0.1 and 0.4. Only two eyes had a visual acuity between 1/50 and 0.05. Twenty eyes, almost a quarter of all those treated, became blind with either no light perception or light perception only or detection of hand movements. The risk of severe visual loss was highly dependent on the type of fundus appearance at the start

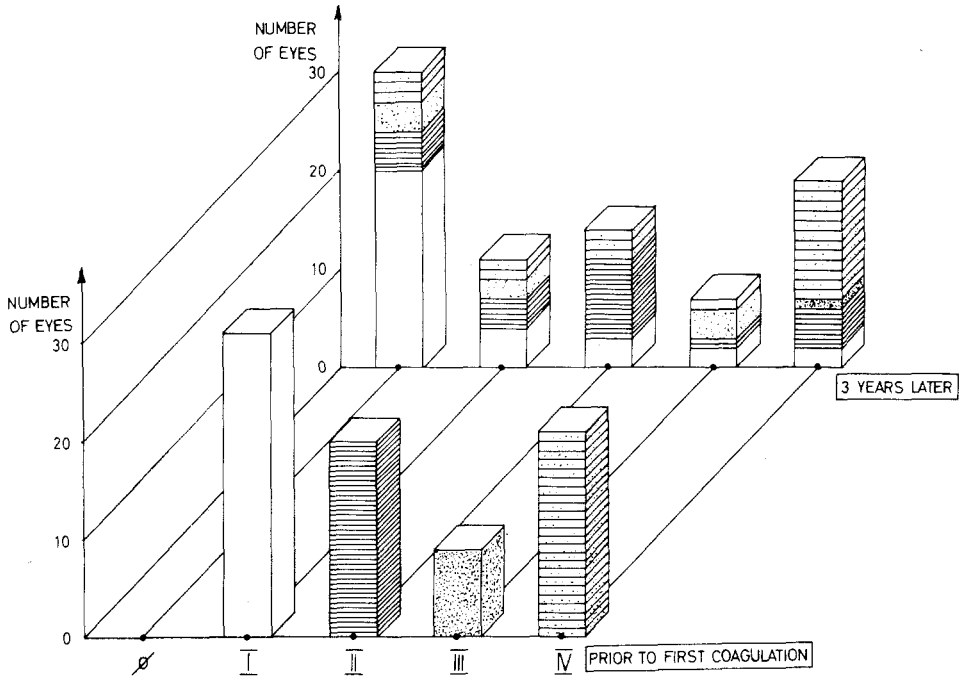

Fig. 2. Fundus appearance prior to first coagulation and 3 years later. Symbols as in Figure 1

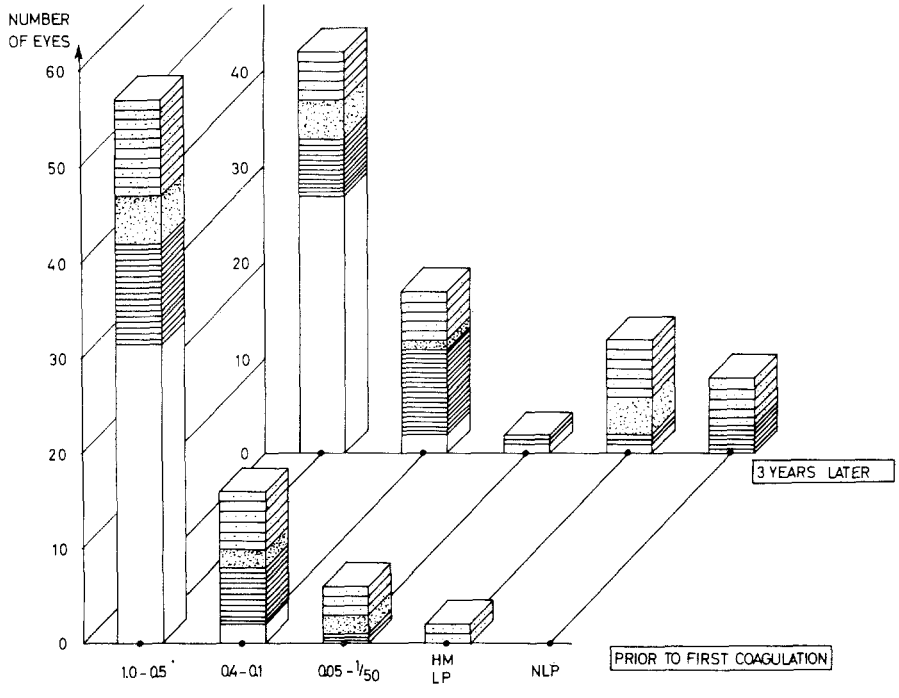

Fig. 3. Visual acuity prior to first coagulation and 3 years later. Each column is divided according to the fundus changes. Symbols as in Figure 1. HM = hand movements visible; LP = light perception; NLP = no light perception

of treatment. Despite treatment, the prevalance of blindness was: type I: 1 of 31 eyes (3%), type II: 4 of 20 eyes (20%), type III: 4 of 9 eyes (44%), type IV: 11 of 21 eyes (52%).

Dose of Coagulation

The amount of coagulation given was calculated on the basis of 3° diameter spots. The different grades of retinopathy received varying amount of coagulation, although they were not significantly different. In the eyes in which proliferation disappeared completely after 3 years of treatment, 325 ± 151 coagulation spots of 3° diameter (mean ± SD) were given to the type I eyes compared with 437 ± 125 spots to the type II eyes ($p < 0.05$), and 603 ± 107 to the type IV eyes ($p < 0.01$ versus type I).

Discussion

This study concerned a well-defined group of diabetic patients with the worst visual prognosis. In 14 comparable patients, 19 out of 28 eyes became blind within 9

months [6]. Fifty percent of young onset Type I diabetic patients with proliferative retinopathy were blind after an observation period of 5 years [4]. In another study [8], the worst results were obtained in a group of young diabetic patients with florid proliferative retinopathy. It has been claimed that florid diabetic retinopathy might be treated better by hypophysectomy than by photocoagulation [5]. In this study, we have attempted to differentiate various types of retinal morphology. By classifying the patients before treatment, we have shown that the final result was greatly influenced by the initial type of retinal appearance. This indicates that the timing of treatment in a progressive retinopathy might be of great importance. This, however, cannot be evaluated by the present study because we had to assess and treat the patients as they presented. In the past few years we have followed a large group of young patients without diabetic retinopathy, in whom we could choose the optimal time for the start of treatment on its appearance. We think that treatment is indicated when the first signs of florid proliferative retinopathy are detected. This study also indicates that, with rare exceptions, one single session of treatment is not sufficient to prevent further disease. This emphasizes that, after the beginning of photocoagulation, close and careful follow-up is very important.

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