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Five-year visual outcome following laser photocoagulation of diabetic macular oedema

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Learning objectives

Upon completion of this activity, participants will be able to:

1. Compare visual outcomes associated with laser photocoagulation treatment of diabetic macular oedema in a real-life, inner-city setting with those obtained in a clinical trial
2. Describe the effects of systemic risk factors on visual outcomes of laser photocoagulation treatment at 5 years in the real-life, inner-city setting
3. Describe the effects of other factors on visual outcomes of laser photocoagulation treatment at 5 years in the real-life, inner-city setting

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CLINICAL STUDY

Five-year visual outcome following laser photocoagulation of diabetic macular oedema

S Jyothi and S Sivaprasad

Abstract

Objective **To evaluate the 5-year visual outcome associated with laser photocoagulation treatment of diabetic macular oedema (DMO), and to investigate the relationship between systemic factors and visual outcomes in a real-life setting.**

Methods **The mean annual visual outcomes and systemic parameters of 100 consecutive subjects with type 2 diabetes who underwent the first session of focal/grid macular laser photocoagulation for clinically significant macular oedema between 2003 and 2004 were collected retrospectively and compared with the outcomes of the laser arm of the Diabetic Retinopathy Clinical Research Network (DRCRN trial comparing intravitreal triamcinolone acetonide injection with laser photocoagulation treatment for DMO). The primary outcome measures included the mean change in visual acuity (VA) in 5 years and the influence of systemic factors on final visual outcome.**

Results **The mean change in VA at 5 years was −5.23 in a real-life setting for an inner city population. The 3-year outcome was inferior to the clinical trial results with more people gaining vision (≥15 letter gain) in the DRCRN group compared with this cohort (26 *vs* 9%). Furthermore, three times more patients lost vision (>15 letter loss) in the real-life setting of this cohort compared with the clinical trial results of the DRCRN group (27 *vs* 8%, respectively).**

Conclusions **The visual outcomes and the control of systemic factors of patients with DMO in this cohort were inferior to those recruited for the clinical trial involving the DRCRN group.**

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Keywords: diabetic macular oedema; laser photocoagulation; ethnicity

Introduction

Diabetic maculopathy continues to be the leading cause of new onset vision loss among working age populations.[1] The Early Treatment of Diabetic Retinopathy Study (ETDRS) demonstrated that focal or grid laser photocoagulation reduced the risk of moderate visual loss in patients with clinically significant macular oedema (CSMO) by ~50% (from 24 to 12%) at 3 years, although visual acuity (VA) improvement was observed in <3% of cases, based on 15-letter gain at 3 years.[2] Despite the unsatisfactory outcomes, this treatment remains the gold standard of the treatment for CSMO. Indeed, recent clinical trials conducted by the Diabetic Retinopathy Clinical Research Network (DRCRN.net) indicate that the outcomes associated with macular laser treatment have improved significantly.[3,4] Advances in laser technology and optimisation of glycaemia and blood pressure (BP) control have been attributed to these beneficial outcomes.[5] Similarly, contemporary studies also suggest that the prevalence of diabetic retinopathy is decreasing when compared with the Wisconsin Epidemiologic Study of Diabetic Retinopathy published in 1984.[6] This decline in diabetic retinopathy prevalence is also thought to be because of the enhanced control of systemic factors.[7–9]

For more than a decade, the lessons from the UK Prospective Diabetes Study (UKPDS)[10] and the Diabetes Control and Complications Trial[11] studies have governed our clinical practise with regard to the management of diabetic

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retinopathy and macular oedema (DMO). Strict glycaemic and BP control remain the most effective interventions to date. Given that contemporary clinical trials and prevalence data suggest an improvement in visual outcomes and better control of risk factors, we conducted a retrospective study to assess the 5-year visual outcome associated with macular laser photocoagulation (2003–2009) in a clinic-based setting catering to a multiethnic inner city population. We also determined the effect of systemic factors on visual outcomes to evaluate whether similar outcomes are obtained in real-life settings.

Methods

The protocol for this study was approved by the Chair of the institutional review board. The project was also registered in the Clinical Effectiveness Department of the institution. The study adhered to the tenets of the Declaration of Helsinki.

Study population

This study was carried out at the King's College Hospital, London, UK, where an established diabetic retinopathy screening programme caters to a multi-racial community with high levels of social and material deprivation. One-third of the total study population was drawn from Black and Ethnic minority groups. Individuals were graded as having diabetic maculopathy based on post-mydriatic two-field colour fundus photographs. These screen-positive patients were referred to the retinal clinics where a clinical examination and additional investigations (eg, fundus fluorescein angiography) were performed before laser photocoagulation. Optical Coherent tomography (OCT) was not available at baseline examinations.

Study design

Consecutive patients with type 2 diabetes and DMO who required their first macular laser photocoagulation in 2003–2004 were identified from the laser register. In bilateral cases, the first eye treated in each patient was included in the study. In cases in which both the eyes were treated during the same session, the eye with the poorer baseline VA was included. Patients who did not complete the 5-year follow-up were excluded from the study and the reasons for being lost to follow-up were recorded.

Laser photocoagulation

The focal/grid photocoagulation protocols used in the department mirror the DRCRN.net protocols (modified from the original ETDRS protocol).[1] In brief, the treatment was performed with a 514 nm green laser light Iridex Oculite GLx (Iridex Corp., Mountain View, CA, USA) with a spot size of 75–125 μm and an exposure time of 100 ms to obtain a light grey–white (just visible) burn and applied in a focal or grid pattern to cover the area of oedema.

The patients were reviewed every 4–6 months, unless they failed to attend an appointment. Laser treatment was repeated if clinical, angiographic and more recently, OCT evidence indicated a persistence of macular thickening. No distinction was made between focal or grid lasers in this study, because in clinical practise, many patients tend to have both on long-term follow-ups.

Visual acuity

VA was recorded using the Snellen VA charts in the early years, followed by the ETDRS charts at 2 m. As a result, all VA recordings were converted to ETDRS scores for this study. The VA examiners were not certified and the VA measurements were recorded in busy clinic settings. Under these circumstances, it is possible that the examiner did not spend enough time to encourage the patient to read as far as possible. As a result, the best-corrected VA may have been underestimated at times. The mean annual visual outcome was defined as the average of all VA measurements recorded per year.

Ocular and medical co-morbidity

All annual clinical data regarding ocular and medical history, including laboratory values, were obtained retrospectively from the electronic patient record, clinical files and laboratory records. Data collected that was related to systemic factors included age at first laser treatment, gender, ethnicity, length of duration of diabetes at baseline, date of initiating insulin therapy, average annual HbA1c levels, mean annual systolic and diastolic BP, number of anti-hypertensive medications at baseline and annually, average annual BMI, history of being on statins, history of cardiovascular co-morbidity, peripheral neuropathy, and foot ulcers.

Data collected that was related to ocular features included mean annual visual outcome, grade of diabetic retinopathy, date of cataract surgery (if carried out), number of macular laser treatments in 5 years, date of initiating pan-retinal photocoagulation (if required), history of any other surgical procedures including date, other ocular co-morbidity, number of retinal clinic

appointments in 5 years, and the number of appointments the subject failed to attend in 5 years.

Statistical analyses

The primary outcome measures in our patients (KCH cohort) included the mean annual change in visual outcomes up to 5 years; the 3 year outcomes were compared with the outcomes of the laser arm in the DRCRN randomised controlled study that compared intravitreal triamcinolone acetonide (IVTA) with laser photocoagulation for DMO.[12] The last observation carried forward method was used to assign 45 missing values over the 5-year study period. Data were expressed as percentages, mean values (with standard deviations) or median values. In the univariate analyses, we compared each of the variables using *t*-tests, Mann–Whitney *U*-test and Fisher's exact test where appropriate. After the univariate analysis, a multivariate logistic regression model of patient characteristics and outcomes was performed to identify the clinical variables associated with gain of vision (ie, losing ≤ 5 ETDRS letters). To correct for multiple comparisons, results were only included in the multivariate analyses when the corresponding $P < 0.01$.[1]

Results

The baseline characteristics of the study cohort are summarised and compared with the DRCRN study population in Table 1. The mean age of the patients at study baseline was 68.8 years (range 38–91 years), with 47 (31%) female and 53 (69%) male patients. A total of 201 clinical notes were screened to identify patients who met the criteria for enrolment; causes for exclusion included lack of adequate follow-up ($n = 54$), lost to follow-up ($n = 32$), and mortality ($n = 15$).

Visual outcomes

The mean change in VA at 3 years was −4.15 ETDRS letters in the KCH cohort relative to a gain of 5 ETDRS letters in the DRCRN study. In the first year, the percentages of gainers (ie, patients who experienced a loss of ≤ 5 ETDRS letters) were similar in both groups (73% in the KCH cohort *vs* 74% in the DRCRN laser group). However, by the third year, only 50% of the KCH group patients were gainers compared with 83% in the DRCRN laser group. The proportion of gainers in the KCH cohort was relatively similar from the third to fifth years after the first laser treatment (47–50%; Table 2). Only 1 out of 10 KCH cohort members gained ≥ 15 ETDRS letters at year 1, and this result was maintained to year 5. However, in the DRCRN laser group, the number of patients that gained ≥ 15 ETDRS letters nearly doubled from 14% in the first year to 26% in the third year. The results with the KCH cohort are superior to those of the ETDRS study,[2] in which only 3% gained ≥ 15 ETDRS letters. When we considered the proportion of patients with moderate visual loss at 3 years (loss of ≥ 15 ETDRS letters), the outcomes with the KCH cohort are inferior (27%) to those of the DRCRN laser group (8%). Taken together, the results of these comparisons show that the visual outcomes of the KCH cohort are inferior to the visual outcomes of the laser group in the contemporary DRCRN study.

Table 1 Baseline characteristics of the KCH cohort relative to the DRCRN laser group[12]

	DRCRN laser arm	*KCH cohort*	P-*value*
Number of patients	115	100	
Mean age at first laser in years	63	59	
Duration of diabetes at baseline in years	15	13.53	
Mean HbA1c	7.5%	8.5%	
Before laser at baseline	60%	None	<0.0001
Baseline VA	62	67	
Phakic at baseline	79%	91%	
Ethnicity at baseline			
White	74%	38%	<0.0001
Black	9%	47%	<0.0001
Asian	2%	13%	0.0055
Others	15%	2%	0.0015
Type of diabetes			
Type 1	4%	0%	0.1
Type 2	96%	100%	
Retinopathy status at baseline			
Mild	58%	85%	<0.0001
Mod	14%	6%	
Severe	28%	6%	
PDR	16%	3%	

Abbreviations: DRCRN, Diabetic Retinopathy Clinical Research Network; HbA1C, glycosylated haemoglobin; PDR, proliferative diabetic retinopathy; VA, visual acuity.

Mean number of laser treatments

The mean number of laser treatments over the 5-year study period for the KCH cohort was 2.74 ± 1.6. Table 3 shows the number of laser treatments for the KCH cohort compared with the DRCRN laser group. The mean number of laser treatments performed was less for the KCH cohort, and more patients in the KCH cohort had only one laser session compared with the DRCRN laser group, despite the fact that 60% of the DRCRN group had previous laser treatment and 13% of the DRCRN

Table 2 Annual mean visual outcomes of the KCH cohort compared with the DRCRN laser group outcomes[12]

Changes in VA	*KCH first year*	*DRCRN first year*	*KCH second year*	*DRCRN second year*	*KCH third year*	*DRCRN third year*	*KCH fourth year*	*KCH fifth year*
Mean	−0.48 ± 11.74	1 ± 16	−2.08 ± 14.62	2 ± 17	−4.15 ± 15.2	5 ± 17	−4.03 ± 15.34	−5.23 ± 17.2
Median (95% CI)	0 (−2.7, 1.8)	3 (−5, 10)	0 (−4.9, 0.79)	5 (−5, 12)	−4 (−7, −1)	8 (−2, 15)	−5 (−7, −1)	−5 (−8.6, −1.8)
≥15 letter gain (%)	10	14	10	20	9	26	13	12
10–14 letter gain (%)	11	14	6	14	5	18	2	4
5–9 letter gain (%)	10	17	18	17	14	18	12	9
No change ± 4 letters (%)	42	29	27	22	22	21	20	22
5–9 letter loss (%)	6	9	8	9	12	4	17	16
10–14 letter loss (%)	7	3	10	6	11	4	8	10
>15 letter loss (%)	14	14	21	13	27	8	28	27

Abbreviations: DRCRN, Diabetic Retinopathy Clinical Research Network; VA, visual acuity.

Table 3 Number of laser treatments in the KCH cohort compared with the DRCRN laser group

Number of laser treatments	*DRCRN laser group (third year)*	*KCH cohort (third year)*	*KCH cohort (fifth year)*
Once	19	32	23
Two sessions	24	28	32
Three sessions	25	20	21
Four sessions	18	5	8
Five sessions	10	7	8
Six sessions or more	4	8	8
Mean laser sessions	2.9 ± 1.4	2.54 ± 2.0	2.74 ± 1.6

Abbreviation: DRCRN, Diabetic Retinopathy Clinical Research Network.

Table 4 Changes in HbA1C and blood pressure in KCH cohort over the 5-year study period

	KCH baseline	*KCH year 1*	*KCH year 2*	*KCH year 3*	*KCH year 4*	*KCH year 5*
HbA1C Mean ± SD (range)	9.25 ± 1.99 (5.7–15.4)	9.17 ± 2.09 (5.6–18.6)	9.4 ± 2.06 (5.8–15.6)	8.82 ± 1.87 (4.4–13.5)	8.85 ± 1.82 (5.5–16.8)	8.7 ± 1.81 (6.2–16.8)
Systolic BP Mean ± SD (range)	143 ± 23.37 (93–234)	142 ± 21.31 (94–195)	144 ± 22.36 (82–200)	142 ± 19.70 (95–190)	140 ± 21.76 (92–200)	141 ± 21.57 (84–204)
Diastolic BP Mean ± SD (range)	80 ± 11.56 (50–122)	79 ± 11.88 (52–110)	78 ± 12.15 (43–105)	77 ± 10.7 (46–105)	75 ± 11.51 (50–108)	77 ± 11.59 (50–108)

Abbreviations: BP, blood pressure; HbA1c, glycosylated haemoglobin.

group had additional treatments other than laser (eg, IVTA and bevacizumab). All of the patients in the KCH cohort were treatment naive and none of the KCH cohort patients received any additional intravitreal treatments. Notably, the proportion of patients having four or more laser sessions in the KCH group was less than that in the DRCRN group.

Influence of systemic factors on visual outcomes at 5 years

Table 4 shows the mean annual changes in HbA1C and systolic and diastolic BP in the KCH cohort over 5 years in the current era of improved glycaemia and BP control relative to the DRCRN cohort. Although the mean HbA1C and BP values in the KCH cohort improved slowly over the 5-year study period, the overall control of risk factors for the KCH cohort was inferior to the baseline data for the DRCRN laser group.

Univariate analyses of the known risk factors are shown in Table 5. Gainers were defined as those who lost ≤5 ETDRS letters; the rest were termed losers. Insulin users, BMI ≥25, better baseline VA (≥55 ETDRS letters), number of laser treatments (a surrogate marker of severity of DMO), and more number of failed appointments were associated with poorer visual

Table 5 Univariate analysis of the prognostic systemic and ocular factors for gain in vision after macular laser treatment for DMO

	Gainers (n = *47*)	*Losers* (n = *53*)	P-*value*
Systemic factors			
Age at baseline (years)			
<65	26	11	0.8
≥65	35	28	0.3
Ethnic groups			
Caucasians	20	17	0.3
Non-Caucasians	27	36	
Gender			
Male	25	28	0.2
Female	22	25	
Duration of diabetes (years)			
<15	26	37	0.9
≥15	21	16	0.4
Diabetic medications			
Oral	11	10	0.009
Insulin/oral + insulin	36	43	
Time to start of insulin			
Before first laser	24	22	0.9
During the 5 years	7	12	0.8
Baseline HbA1C			
<7.5	8	13	0.5
≥7.5	39	40	0.9
Baseline systolic BP, mm Hg			
<140	21	24	0.4
≥140	26	29	0.7
Baseline diastolic BP, mm Hg			
<90	36	41	0.9
≥90	11	12	0.3
Number of antihypertensives at end of follow-up			
0–2	22	33	0.09
≥3	25	20	
Baseline BMI			
<25	9	6	0.7
≥25	38	47	0.0006
Ocular factors			
Baseline VA (ETDRS letters)			
<55	10	6	0.001
≥55	20	23	0.4
Lens status: phakic	44	48	
Previous pseudophakia	3	5	0.2
Pseudophakia during study	2	5	
DR status at baseline			
Non-PDR	43	48	0.3
PDR	4	5	
Number of macular laser treatments			
1–3	39	37	0.008
>3	8	16	
Number of clinic appointments			
Mean	19.23	19.6	
Range	4–34	3–39	
Number of failed clinic appointments			
Mean	3.02	3.75	0.009
Range	0–7	0–12	

Abbreviations: BMI, body mass index; BP, blood pressure; DM, diabetes mellitus; DMO, diabetic macular oedema; ETDRS, early treatment diabetic retinopathy study; HT, hypertension; PRP, pan-retinal photocoagulation.
Gainers: loss of <5 ETDRS letters; losers: loss of ≥5 ETDRS letters.

Table 6 Multivariate model for visual outcome at 5 years

Factors with P<*0.01 in univariate*	*95% CI*	P-*value*
Type of anti-diabetics	−8.732 to −0.9495	0.0152
Baseline BMI	−0.2670 to 1.059	0.2378
Baseline VA	−0.6238 to −0.1634	0.0010
No. of macular lasers	−3.109 to 0.7052	0.2132
No. of failed appointment	−3.191 to 0.1071	0.0661

Abbreviations: BMI, body mass index; CI, confidence interval; VA, visual acuity.

outcome. However, the multivariate model showed that better baseline VA and insulin users were the only poor prognostic indicators (Table 6).

Discussion

Laser photocoagulation remains the standard treatment for patients with CSMO. The main objective of laser treatment is to prevent visual loss, rather than improve vision. Nevertheless, contemporary studies on laser photocoagulation for CSMO indicate that the visual outcomes with macular laser treatment are much better than those obtained with the ETDRS study with ~1 in 4 gaining ≥15 ETDRS letters by 3 years.[1,13,14] The suggested reasons for this improvement include better glycaemic and BP control and perhaps early detection and prompt treatment of cases compared with a decade ago. However, our study in a clinical setting catering to a multiracial inner city population shows that the long-term results (3–5 years) are inferior to those obtained in clinical trials with ~12% showing improved vision and 26% suffering moderate vision loss at 5 years.

We assessed a number of factors that may determine the poorer outcome. These factors included demographics, ocular and systemic factors and issues associated with healthcare provisions. Compared with the DRCRN study (baseline data comparing IVTA to laser for DMO), the KCH cohort was younger and contained more ethnic minority groups. But the treatment outcomes for Caucasians and other ethnic groups were not dissimilar ruling out inequalities to access to health care (data not shown).

The mean HbA1C of our group was 8.5% compared with 7.5% in the DRCRN group. HbA1c levels of ≥ 8 are associated with an increased risk of macular oedema, irrespective of the ethnic group.[15] In a recent report in our population, we found that the risk of diabetic maculopathy independent of the ethnic group is significantly higher in subjects registered with family practices with the lowest quartile of HbA1c achievement.[16,17]

However, the present study results reflect those of the DRCRN group, indicating that the levels of HbA1C do not influence the outcomes of macular laser treatment. Thus, decreasing HbA1C levels is more important with regard to the prevention of maculopathy than with maculopathy treatment. This finding suggests that over time, other factors such as increased vascular endothelial growth factor levels may dominate the course of the disease.[18] Patients in the KCH cohort also had higher systolic and diastolic BP compared with the DRCRN group. Again, this difference may be explained in part by the differential susceptibility of the African–Caribbean group to high BP. However, unlike the ETDRS study, the DRCRN study reported that baseline systolic BP and mean arterial BP did not influence VA outcomes. Despite the higher BP in the KCH cohort, univariate analyses did not reveal BP as a predictive factor. As discussed above with regard to HbA1C, epidemiological studies and clinical trials strongly support hypertension as an important modifiable risk factor for diabetic retinopathy.[19] In the UKPDS study, tight BP control reduced the risk of retinopathy progression by about one-third, visual loss by one-half and the need for laser treatment by one-third in patients with type 2 diabetes. Similarly, the EUCLID study,[20] DIRECT study,[21] and RASS study[22] show positive outcomes for anti-hypertensives on retinopathy risk. However, these are risk reduction strategies for the development and progression of DR. Although both HbA1C and BP must be optimally controlled to decrease the rate of incident DR and maculopathy, they do not appear to influence laser treatment outcomes as shown in the current study and based on the analysis of the DRCRN group.[1]

Owing to the large number of variables evaluated, we only considered associations with a $P<0.01$ to be significant. Poor prognostic indicators included insulin users, less number of laser treatment sessions, more number of missed clinic appointments, better baseline VA, and BMI ≥ 25. Nevertheless, only a few of the variables met a $P<0.05$ value threshold in multivariate analyses; they were the univariants, being on insulin medication and baseline VA. Similar to the analyses of the DRCRN group,[1] we found that visual improvement was better in eyes with poorer baseline VA (<55 ETDRS letters). These types of ceiling and floor effects have been reported for treatment outcomes associated with both diabetic maculopathy and age-related macular degeneration.[1,23] The duration of oedema may be an important determinant of final visual outcomes, but this factor was not analysed directly in the current study. Nevertheless, the poorer results in year 3–5 may serve as a surrogate marker of chronicity of disease.

Despite the fact that all our patients were treatment naive at baseline, the mean number of laser applications was only 2.7 at 5 years compared with 2.9 at 3 years in the DRCRN group. Although it did not reach a significant level in the multivariate model, the number of laser applications is an important factor that may have influenced our outcomes. The high threshold among retinal specialists to perform more lasers when 2–3 attempts have not shown a positive response should change based on recent data reported by the DRCRN indicating that the probability of improvement of eyes treated previously with laser ≥ 3 times had a similar chance of VA improvement as eyes that had not had previous laser treatment.[4] Taken together, these findings suggest that it is useful to proceed with further laser treatment if there is sufficient space to apply more burns. It is also important to note that the response to laser treatment is slow, and that persistent oedema after one to two laser treatments should not deter physicians from re-treating.

Another significant problem in the real-life setting of urban populations is the lack of awareness of diabetic retinopathy and its associated complications. In all, 22% of the patients in our recent study of urban populations failed to attend screening appointments[16] with the highest non-attendance reported among 18–34 year olds. In this study, $\sim 50\%$ of the subjects were not followed-up regularly, and 16% were lost to follow-up. Therefore, our results may be worse than reported if the outcomes for the lost patients were known. Our current screening and treatment guidelines ensure that patients with sight-threatening disease are promptly referred and treated. However, the major challenge of providing timely monitoring and treatment appointments for these patients remains unaddressed.

The strength of this study is that it included the largest number of patients with DMO who had macular laser

treatments in real-life settings with long-term follow-up, thereby allowing the results to be compared with outcomes from contemporary clinical trial results. However, a limitation of this study is its retrospective nature. Despite the fact that we recruited consecutive patients with 5-year follow-up, ~50% of the patients did not complete the 5-year follow-up or did not have at least one annual follow-up visit during this time period. Therefore, we can only postulate that the results may be inferior to our present data if all patients would have been followed. Finally, we did not differentiate between focal and diffuse macular oedema in this study, as angiograms were not available in all cases.

In summary, this study shows that retinal specialists should contemplate further laser treatments in patients with persistent oedema despite potential initial non-responsiveness to laser treatment. Rigorous measures should be initiated to ensure timely follow-up to avoid non-attendance and resultant loss of vision of these high risk individuals.

Summary

What was known before

- Long-term laser photocoagulation outcome for diabetic macular oedema in clinical trials setting.

What this study adds

- Long-term laser photocoagulation outcome for diabetic macular oedema in real-life settings.

Conflict of interest

Sobha Sivaprasad has received travel grants, research grants, and attended advisory board meetings for Pfizer, Novartis, and Allergan.

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Medscape EDUCATION

Five-year visual outcome following laser photocoagulation of diabetic macular oedema

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1. You are considering laser photocoagulation treatment for diabetic macular edema in a 69-year-old Hispanic man being followed in an inner-city clinic. On the basis of the above study by Jyothi and Sivaprasad, which of the following statements is **most likely** to apply to his anticipated visual outcomes?

- A At 1 year, nearly three quarters of patients in the real-life setting had a loss of $\leq$5 ETDRS letters
- B At 3 years, one-quarter of patients in the real-life setting had a gain of $\geq$15 letters
- C At 3 years, $\sim$10% of patients in the real-life setting had a loss of >15 letters
- D At 5 years, $\sim$25% of patients in the real-life setting had improved vision and $\sim$10% had moderate vision loss

2. For the patient described in question 1, which of the following statements about the anticipated effect of systemic risk factors on 5-year visual outcomes of laser photocoagulation treatment is **most likely** correct?

- A Control of systemic factors is likely to be the same as or better than that achieved in the Diabetic Retinopathy Clinical Research Network (DRCRN) trial
- B Mean haemoglobin A1c and blood pressure values in the real-life setting improved slowly over the 5-year study period
- C A1c levels are likely to affect the outcomes of laser treatment
- D Blood pressure levels are likely to affect the outcomes of laser treatment

3. On the basis of the above study by Dr Jyothi and Dr Sivaprasad, which of the following statements about the effect of other factors on visual outcomes of laser photocoagulation treatment at 5 years in the real-life, inner-city setting is **most likely** correct?

- A In the multivariate model, number of failed appointments was associated with poorer visual outcome
- B Black patients had poorer outcomes than white patients
- C Patients in this study have the same number of laser treatments as did those in the DRCRN laser group
- D Better baseline visual acuity was a poor prognostic indicator for treatment outcome

Activity evaluation

1. The activity supported the learning objectives.

Strongly disagree				Strongly agree
1	2	3	4	5

2. The material was organized clearly for learning to occur.

Strongly disagree				Strongly agree
1	2	3	4	5

3. The content learned from this activity will impact my practice

Strongly disagree				Strongly agree
1	2	3	4	5

4. The activity was presented objectively and free of commercial boas.

Strongly disagree				Strongly agree
1	2	3	4	5