

Study on Treatment Strategies for Diabetic Macular Edema Complicated with Different Stages of Retinopathy

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Abstract: Objective To explore treatment strategies for diabetic macular edema complicated with diabetic retinopathy at different stages. Methods Ninety-six patients admitted from January 2023 to January 2025 were selected and divided into a study group and a control group, with 48 cases in each group. The control group received anti-VEGF therapy, while the study group received staged combined treatment, including laser, glucocorticoid, or surgical intervention according to disease stage. Results Visual acuity improvement, reduction of central foveal thickness, and lesion stability in the study group were better than those in the control group, and the recurrence rate was lower. Conclusion Staged comprehensive treatment is more effective in controlling recurrent edema and delaying disease progression, showing high clinical value.

Keywords: diabetic macular edema, diabetic retinopathy, staged treatment, anti-VEGF, visual function

1. Introduction

As diabetes prevalence continues to rise, visual dysfunction from fundus microvascular injury has become increasingly prominent, with diabetic macular edema, involving the central visual area, causing reading difficulty, distortion, and quality-of-life decline even before advanced disease [1]. More than simple macular exudation, edema accompanied by staged diabetic retinopathy shows layered fundus changes: microaneurysms and focal leakage in mild to moderate non-proliferative disease, extensive non-perfusion in severe stages, and neovascularization, vitreous hemorrhage, or traction in proliferative disease [2]. Thus, limited to edema relief alone, treatment may invite recurrence; guided by staging, anti-VEGF therapy, laser, glucocorticoids, or vitrectomy can better support lasting visual stability under chronic, progressive, fluctuating disease conditions.

2. Materials and Methods

2.1 General Data

Ninety-six patients with diabetic macular edema complicated with diabetic retinopathy admitted from January 2023 to January 2025 were selected and divided into a control group and a study group according to treatment plan, with 48 cases in each group. In the control group, there were 26 males and 22 females, aged 45–76 years, with a mean age of 60.41 ± 7.18 years; the duration of diabetes was 5–22 years, with a mean of 12.36 ± 3.84 years. In the study group, there were 25 males and 23 females, aged 44–78 years, with a mean age of 61.03 ± 7.26 years; the duration of diabetes was 6–23 years, with a mean of 12.71 ± 3.92 years. No significant differences were found between the two groups in sex, age, disease duration, baseline visual acuity, central foveal thickness, or retinopathy stage ($P > 0.05$), indicating comparability. Inclusion criteria were as follows: meeting diagnostic criteria for diabetic macular edema, with diabetic retinopathy confirmed by fundus photography, OCT, and fundus angiography; age 40–80 years; complete clinical data and good compliance with treatment and follow-up. Exclusion criteria included other fundus diseases such as retinal vein occlusion or age-related macular degeneration; recent intraocular surgery or ocular laser treatment; severe refractive media opacity affecting examination; severe heart, liver, or kidney dysfunction, or interrupted follow-up.

2.2 Methods

The control group received routine intravitreal anti-VEGF injection. Before treatment, intraocular pressure, slit-lamp examination, fundus examination, and OCT were completed; injection was performed under sterile conditions, and later treatment frequency was adjusted according to edema absorption, visual acuity change, and re-examination results, with guidance on blood glucose, blood pressure, and lipid control. On this basis, the study group received stratified treatment according to retinopathy stage and macular edema pattern: patients with mild to moderate non-proliferative retinopathy mainly received anti-VEGF combined with focal laser; those with severe non-proliferative retinopathy received peripheral retinal photocoagulation according to the extent of non-perfusion; those with proliferative retinopathy received panretinal

photocoagulation to control neovascular activity. In patients with recurrent vitreous hemorrhage, obvious vitreous traction, or a tendency toward tractional retinal detachment, indications for vitrectomy were further assessed. For patients with insufficient response to anti-VEGF therapy or persistent or recurrent edema, glucocorticoid therapy was cautiously combined after excluding ocular hypertension and other contraindications.

2.3 Observation Indicators

Best corrected visual acuity, central foveal thickness, macular edema recurrence, and retinopathy progression were compared between the two groups before and after treatment. Best corrected visual acuity was recorded by LogMAR, and central foveal thickness was measured by OCT. Recurrence referred mainly to increased macular fluid, elevated central foveal thickness, and decreased visual acuity after treatment; disease progression was judged comprehensively by fundus photography, OCT, and angiography. Adverse reactions such as increased intraocular pressure, subconjunctival hemorrhage, ocular discomfort, and intraocular infection were also recorded.

2.4 Statistical Methods

SPSS 26.0 was used for statistical analysis. Measurement data were expressed as mean $\pm$ standard deviation and compared by independent-sample t test; count data were expressed as n (%) and compared by χ^2 test. $P < 0.05$ indicated statistical significance.

3. Results

3.1 Comparison of Visual Acuity and Central Foveal Thickness Before and After Treatment

As shown in Table 1, before treatment, no significant differences were found between the study group and the control group in LogMAR visual acuity or central foveal thickness ($P > 0.05$), suggesting similar baseline macular edema and visual impairment. After 3 months of treatment, LogMAR visual acuity and central foveal thickness decreased in both groups, yet the changes were more marked in the study group, where LogMAR visual acuity decreased to 0.41 ± 0.12 and central foveal thickness to $305.62 \pm 40.37 \mu\text{m}$, both better than those of the control group, with significant differences ($P < 0.05$). These results suggest that simple anti-VEGF therapy can reduce macular leakage, while staged treatment combined with laser, glucocorticoid, or surgery offers more stable support for edema absorption and central visual recovery.

Table 1. Comparison of Visual Acuity and Central Foveal Thickness Before and After Treatment

Group	Cases	Pre-treatment LogMAR	Post-treatment LogMAR	Pre-treatment CFT (μm)	Post-treatment CFT (μm)
Control group	48	0.71 ± 0.17	0.55 ± 0.15	461.28 ± 61.46	362.74 ± 47.83
Study group	48	0.72 ± 0.18	0.41 ± 0.12	463.15 ± 62.09	305.62 ± 40.37
t value	—	0.280	5.046	0.148	6.318
P value	—	> 0.05	< 0.05	> 0.05	< 0.05

3.2 Comparison of Recurrence, Progression, and Safety

As shown in Table 2, during follow-up, 8 cases of macular edema recurrence occurred in the control group, with a recurrence rate of 16.67%, and 7 cases showed retinopathy progression, with a progression rate of 14.58%; in the study group, recurrence occurred in 3 cases, with a rate of 6.25%, and progression occurred in 2 cases, with a rate of 4.17%, with significant differences between the two groups ($P < 0.05$). In terms of safety, the control group had 2 cases of increased intraocular pressure, 2 cases of subconjunctival hemorrhage, and 1 case of ocular discomfort, with an overall adverse reaction rate of 10.42%; the study group had 2 cases of increased intraocular pressure, 1 case of subconjunctival hemorrhage, and 1 case of ocular discomfort, with an overall rate of 8.33%, and no significant difference was found between groups ($P > 0.05$). Thus, stratified comprehensive treatment was more effective in reducing edema recurrence and retinopathy progression, without clearly increasing ocular adverse reactions.

Table 2. Comparison of Recurrence, Progression, and Safety

Group	Cases	Macular edema recurrence	Retinopathy progression	Increased IOP	Subconjunctival hemorrhage	Ocular discomfort	Total adverse reactions
Control group	48	8 (16.67%)	7 (14.58%)	2 (4.17%)	2 (4.17%)	1 (2.08%)	5 (10.42%)
Study group	48	3 (6.25%)	2 (4.17%)	2 (4.17%)	1 (2.08%)	1 (2.08%)	4 (8.33%)
χ^2 value	—	4.800	5.031	—	—	—	0.123
P value	—	< 0.05	< 0.05	—	—	—	> 0.05

Overall, the study group showed clearer structural improvement, lower recurrence, and better progression control, which may be related to staged intervention covering key pathological links. In mild to moderate non-proliferative retinopathy, treatment mainly targets local leakage, and focal laser helps maintain suppression of macular fluid accumulation; in severe non-proliferative retinopathy, attention to non-perfusion areas may help block later progression; in proliferative retinopathy, neovascular activity, vitreous hemorrhage, and traction interact, and single-drug control is often insufficient, while panretinal photocoagulation or necessary surgery may improve fundus stability. This also indicates that the effect of diabetic macular edema treatment should not be judged only by short-term thickness reduction, but also by recurrence, progression, and safety.

4. Discussion

Diabetic macular edema should not be viewed as a lesion confined to the macula, since retinal microcirculatory damage, increased vascular permeability, and ischemic change usually act together, and, with retinopathy advancing, peripheral non-perfusion, neovascularization, vitreous hemorrhage, and traction may further drive edema recurrence [3]. Although anti-VEGF therapy can rapidly reduce leakage and improve macular morphology, limited to local edema control alone is its long-term value when staging features and systemic metabolic fluctuation are insufficiently considered. In this study, baseline LogMAR visual acuity and central foveal thickness were comparable between groups, yet after treatment the study group showed greater improvement, with LogMAR visual acuity reduced to 0.41 ± 0.12 and central foveal thickness to $305.62 \pm 40.37 \mu\text{m}$, better than the control group. Also lower were the recurrence rate and progression rate in the study group, at 6.25% and 4.17%, while the control group reached 16.67% and 14.58%. These results suggest that staged comprehensive treatment, relying on focal laser, panretinal photocoagulation, glucocorticoids, or vitrectomy according to lesion features, can address leakage, ischemia, neovascularization, and traction more systematically, without markedly increasing adverse reactions, and thus supports continuous management centered on staging assessment [4].

In summary, the value of diabetic macular edema treatment lies not only in reduced macular thickness and short-term visual improvement, but also in disease progression control and long-term visual quality maintenance. For diabetic retinopathy at different stages, selecting matched interventions based on stratified assessment can reduce therapeutic blindness and allow drugs, laser, and surgery to play their respective roles; with strengthened follow-up management and systemic metabolic control, patient benefit may become more stable and lasting.

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