Vitrectomy in the management of diabetic macular edema in treatment-naïve patients

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ABSTRACT

Objective: To determine the efficacy of vitrectomy in eyes with treatment-naïve diabetic macular edema (DME).

Methods: Consecutive patients with treatment-naïve DME who underwent pars plana vitrectomy with internal limiting membrane peeling at a single institution were identified from the electronic medical records. Morphologic and visual acuity changes from baseline were analyzed at both the primary temporal endpoint (6 months) and the final examination with the investigators. The primary outcome measures included changes in best-corrected visual acuity (BCVA) and central retinal thickness (CRT).

Results: Forty-four eyes of 44 patients were included in this retrospective study. The mean BCVA improved significantly from baseline until the 6-month primary endpoint (1.35 logMAR vs 0.83 logMAR, $p < 0.001$) and stabilized through the final examination (0.77 logMAR). The BCVA improved by at least 0.1, 0.3, and 0.6 logMAR in 26 (60%), 24 (55%), and 14 (32%) of eyes, respectively, whereas it worsened by 0.3 logMAR in only 1 (2%) eye. Final BCVA correlated inversely with duration of diabetes ($p = 0.01$), presence of an epiretinal membrane ($p = 0.02$), and initial visual acuity ($p = 0.03$). Mean CRT decreased significantly from baseline through 6 months (595 μm vs 266 μm; $p < 0.001$), and edema recurred in only 3 eyes (6%), one of which was subsequently treated with intravitreal bevacizumab.

Conclusions: Pars plana vitrectomy significantly improves macular edema and visual acuity in eyes with treatment-naïve DME. Prospective randomized trials are needed to better determine the efficacy of early vitrectomy.

Many DME studies limited the use of vitrectomy to eyes that responded poorly to previous laser photocoagulation and intravitreal pharmacotherapy.[1] Long-standing edema in these eyes may have already permanently damaged the inner retina and photoreceptors; thus, despite improved anatomy after vitrectomy, visual acuity increases were unlikely. Some investigators believe that performing vitrectomy before the onset of irreversible retinal injury may both resolve macular edema and significantly improve visual acuity (Toshinori Murata, Vail, (conference presentation- Vail Vitrectomy Meeting) CO; March 18, 2013).[2] To test this theory, we studied the efficacy of vitrectomy that had been performed in eyes with treatment-naïve DME.

Materials and Methods

This retrospective study was approved by the Institutional Review Board of the Ophthalmic Clinic in Lodz, Poland, and it complied with the tenets of the Declaration of Helsinki. Eligible patients were identified from the medical and surgical records of the clinic.

The primary temporal endpoint was the 6-month postoperative visit, but data from the final postoperative visit with the investigators were also analyzed and reported. Primary functional and anatomic endpoints included changes in best-corrected visual acuity (BCVA) and central retinal thickness (CRT).

Medical records of all patients who underwent pars plana vitrectomy for DME from 2007 through 2013 were evaluated, and those who met the inclusion criteria were included in the study. Inclusion criteria consisted of the following conditions: (*i*) treatment-naïve DME; (*ii*) CRT greater than 300 μm on spectral-domain optical coherence tomography (SD-OCT); and (*iii*) DME of at least 3 months' but less than 12 months' duration.

Exclusion criteria included the following: (*i*) previous macular laser photocoagulation (panretinal photocoagulation for proliferative diabetic retinopathy performed at least 6 months before study entry was not exclusionary); (*ii*) previous periocular or intravitreal corticosteroids (except those used in conjunction with cataract surgery); (*iii*) previous intraocular or systemic anti-VEGF treatment; (*iv*) visually significant cataract; (*v*) previous intraocular surgery, except for uncomplicated cataract extraction; (*vi*) active proliferative diabetic retinopathy that required pan-retinal photocoagulation; (*vii*) ischemic maculopathy on fluorescein angiography; (*viii*) glaucoma; and (*ix*) patients who were unable to return for postoperative evaluations through 6 months.

Data from the preoperative baseline visit, 6-month postoperative visit, and final visit were collected and analyzed (Table 1). These included a brief systemic medical history, best-corrected Snellen visual acuity, slit-lamp biomicroscopy, funduscopic examination,

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Table 1—Summary of key baseline data for patients included in the study

Number of eyes	44
Mean age (range), years	59 (26–80)
Visual acuity	1.2 logMAR (20/317)
Pseudophakia	7 (16%)
Photoreceptor defects	32/44 (72%)
RPE defects	1/44 (0.02%)
ERM	17/44 (38%)
Pseudophakia	7/44 (15.9%)

RPE, retinal pigment epithelium; ERM, epiretinal membrane.
Preoperative demographic data.

fluorescein angiography (Spectralis; Heidelberg Engineering, Heidelberg, Germany), and SD-OCT (Copernicus HR; Optopol, Poland; Spectralis; Heidelberg Engineering) scanning of the macula. To keep CRT measurements internally consistent, each patient underwent SD-OCT testing on the same machine at each visit. SD-OCT scans were analyzed for the following factors: CRT; ellipsoid zone (EZ) defects; epiretinal membrane (ERM); subretinal fluid; and intraretinal, parafoveal cystoid spaces.

Standard, 3-port, 20-gauge pars plana vitrectomy was performed under local anaesthesia. After core vitrectomy, Membrane Blue or Membrane Blue Dual was injected into the vitreous cavity and left for 30 seconds before removal. The posterior hyaloid was detached with active aspiration (in all cases), after which ERM (if present) and internal limiting membrane (ILM) within 1 disc diameter of the fovea (Fig. 1) were manually removed. Dexamethasone phosphate and antibiotics were injected subconjunctivally at the completion of surgery, and topical antibiotics and corticosteroids were administered for 4 weeks. Lens removal was not performed at the time of vitrectomy.

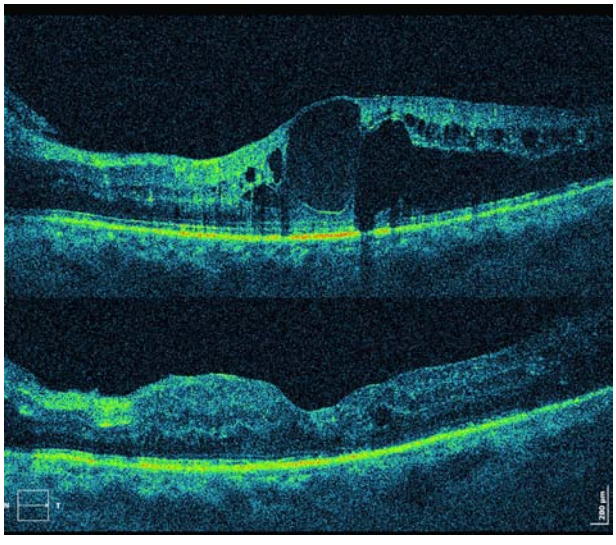

Fig. 1—Patients according to changes in visual acuity. From left to right, the intervals correspond to changes of >+30; +30 to +15; +15 to +5; +5 to 5; 5 to 15; 15 to 30; and <30 ETDRS letters.

Statistical analyses were conducted using SigmaStat 3.5 (Systat) for Windows. Demographic data were characterized by means and standard deviations. Snellen visual acuities were converted to logMAR for comparative analyses. A multivariate analysis was performed to identify factors associated with improved final visual acuity and decreased CRT. Probability values of less than 0.05 were held to be statistically significant.

Results

Forty-four eyes of 44 patients were included in this study (Table 1). The mean age of the patients was 59 years (range: 26–80 years), and 26 (59%) were female. Thirty-eight (86%) patients had type II diabetes, and the mean ± standard deviation duration of diabetes was 16 ± 6.3 years. The mean (%) hemoglobin A1c was 7.5 ± 3.4. Seven eyes were pseudophakic at the time of vitrectomy surgery, and 17 of 34 eyes had an ERM. All patients were evaluated at the 6-month primary endpoint, and the final examinations were performed between 8 and 48 months after vitrectomy.

The mean BCVA improved significantly from baseline through the 6-month primary endpoint (1.35 logMAR [20/448 Snellen] vs 0.83 logMAR [20/135]; $p < 0.001$) and stabilized until the final examination (0.77 logMAR [20/117]). The BCVA improved by at least 0.1, 0.3, and 0.6 logMAR in 26 (60%), 24 (55%), and 14 (32%) of eyes, respectively; it worsened by at least 0.1, 0.3, and 0.6 logMAR in 3 (6%), 1 (2%), and 0 (0%) eyes, respectively (Fig. 1). The BCVA remained unchanged (within 0.1 logMAR—20/25 Snellen or 5 ETDRS letters) of baseline in 14 eyes (32%). The median BCVA improved from 1.3 logMAR (20/400) (25th, 75th percentiles: 1.7 logMAR [20/1000], 0.82 logMAR [20/132]) to 0.7 logMAR (20/100) (25th, 75th percentiles: 1.0 logMAR [20/200], 0.4 logMAR [20/50]) at 6 months (Table 2).

Subsequent cataract removal was performed at the discretion of the treating physician. Of the 37 eyes that were phakic at baseline, 30 (81%) remained phakic through 6 months. Significant improvements in visual acuity were seen in eyes that remained phakic throughout the study ($p < 0.01$) as well as those that underwent cataract removal ($p = 0.03$).

Table 2—Baseline and 6-month findings for key functional and anatomic characteristics

	Before surgery	After surgery
Subfoveal cystoid spaces in ONL subfoveally	44/44 (100%)	3/44 (6%)
Parafoveal cystoid spaces in ONL	44/44 (100%)	13/44 (29%)
Photoreceptor defects	32/44 (72%)	11/44 (25%)
RPE defects	1/44 (0.02%)	5/44 (11%)
ERM	17/44 (38%)	0%
Subretinal fluid	7/44 (15.9%)	0%

ONL, outer nuclear layer; RPE, retinal pigment epithelium; ERM, epiretinal membrane.
Details on retinal morphology before and after vitrectomy for treatment-naïve diabetic macular edema visualized with spectral domain optical coherence tomography.