

Original article

An OCT Based analysis of communications Between Intraretinal and Subretinal Spaces of Neurosensory Detachment in Diabetic Macular Edema

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Abstract

Introduction: The pathogenesis of development and progression of neurosensory retinal detachment (NSD) in diabetic macular edema (DME) is not yet fully understood. The purpose of this study is to report the presence of outer retinal communications, traversing between intraretinal fluid pockets and subretinal space in eyes having NSD in DME and to assess the correlation of size of these communications with the size of NSD and with visual acuity.

Method: This study was conducted on 40 eyes of 32 patients with Type II diabetes. Patients were selected randomly and classified into 3 groups depending on the size of communications between intraretinal and subretinal spaces of NSD.

Results: The communications were seen as focal defects of the outer layers of elevated retina. With increasing size of communication, there was increase in height of NSD, horizontal diameter of NSD and the best corrected visual acuity (in logMAR).

Conclusion: Outer retinal communications between intra and subretinal space were noted in eyes having NSD associated with DME. The size of communications correlated positively with the size of NSD and inversely with BCVA.

Keywords: Diabetic macular edema, neurosensory detachment, outer retinal communications.

Introduction

Diabetic macular edema (DME) is the leading cause of visual loss in diabetes.^[1] Neurosensory retinal detachment (NSD) is a known pattern of DME, apart from cystoid macular edema (CME) and diffuse retinal thickening.^[2] NSD under the fovea has been reported in 5-31% of the patients with DME. Spectral domain optical coherence tomography (SD-OCT) has enabled detailed evaluation of the morphological features of NSD beneath edematous and cystic macula.^[3]

Aims and objectives

The purpose of this study is to report the presence of outer retinal communications, traversing between intraretinal fluid pockets and subretinal space in eyes having NSD in DME and to assess the correlation of size of these communications with the size of NSD, and with visual acuity.

Material and methods

An observational retrospective study, which included 40 eyes of 32 diabetic patients was conducted between January 2015 to March 2016. Of all the cases of DME with NSD who visited our institute in the above mentioned duration, SD-OCT scans were reviewed. The eyes that were found to have outer retinal communications between intraretinal fluid pockets/cysts and subretinal fluid on SD-OCT were included. Exclusion criteria included any vitreo-macular interface disorders, dense media opacities (corneal, lenticular, or vitreal), any history of previous intraocular surgery or vitreo-retinal pathology other than DR and eyes which have undergone Laser photocoagulation or Intravitreal Anti-VEGF treatment. All patients underwent a comprehensive ophthalmologic examination, which included best-corrected visual acuity (BCVA)

measurements, slit lamp biomicroscopy, intraocular pressure measurements using Goldmann applanation tonometry, dilated indirect ophthalmoscopy, SD-OCT with macular thickness measurement, and fluorescein angiography.

Optical Coherence Tomography

Reliable SD-OCT 3(Carl Zeiss, Meditech, Dublin, USA) scans were performed through a dilated pupil. High-resolution images using radial and 3D scan protocols were obtained. NSD was defined as subfoveal fluid accumulation identified as a distinct outer border of the retina seen elevated above the outer border of the highly reflective band, regarded as the signal generated mainly by the retinal pigment epithelium (RPE), with or without overlying foveal thickening. Using the computer-based caliper measurement tool in the SD-OCT system, the height of the NSD (Fig.1) was measured by measuring the distance between the elevated outer edge of the sensory retina and the inner edge of the RPE, at the point of maximum elevation, whether foveal or extrafoveal. The horizontal diameter of NSD (Fig 2.) was measured as the width of the subretinal space, limited at both sides by the junction of the elevated outer edge of sensory retina and the inner edge of the RPE. All the measurements were calculated in microns.

Communication was identified as an open outer border of the cyst or of edematous retina, which communicated with the NSD. In all the included eyes, there were no intraretinal lipid exudates overlying the communications, so as to ensure that the hyporeflectivity associated with the shadowing from exudates was not mistaken as an outer retinal defect. A uniform protocol of measurement was followed; 2 perpendicular lines were drawn from the 2 edges of the communication to the RPE, and the distance between those two points on the RPE was measured with callipers (Fig 3.). The scan with largest diameter of communication is selected. For standardization of measurements, the same measurement protocol (indirect measurements on the RPE) was used for all the communications, including those opening obliquely on the slanting outer surface of the detached retina. The findings were confirmed independently by another retinal specialist. For the analysis, the communications were divided into small (≤ 190 μm)-, intermediate (191-225 μm)-, and large (>225 μm)-sized communications on the basis of measured size.

Statistical analysis

Statistical analysis (correlation test) was performed using SPSS (Statistical Package for Social Sciences, version 19.0, Chicago, IL, USA). Means were compared with independent samples' t-test and categorical data were analyzed with the Chi-square test. A $p < 0.05$ was considered significant.

Results

In the current study, we examined 40 eyes of 32 subjects having DME, including 24 males and 8 females. All patients had type 2 diabetes mellitus. The mean age was 55.5 ± 6.8 years (range: 44-69 years). The eyes were numbered from 1 to 40 in the order of increasing size of communication. The right eye was affected in 21 (52.5%) patients and the left eye in 19 (47.5%) patients. The pattern of DME in the retina overlying the NSD was a combination of CME and diffuse thickening in 33 (82.5%) eyes, and CME alone (17.5%) in 7 eyes. The number of eyes included in the study are 15 with small sized communications, 14 intermediate and 11 with large sized communications. One from each category is shown in the figures below as Fig. 4, fig.5 and fig.6 respectively for small, intermediate and large sized communications. The correlation between dimensions of communication and visual acuity is shown in the graph (Graph 1.) and that between dimensions of NSD and size of communication is shown (Graph 2.)

Discussion

Though the factors resulting in CME pattern of DME are now partly understood, the pathogenesis of NSD in DME is still being debated. Leakage from retinal circulation into subretinal space exceeding drainage capacity of RPE is thought to be the main mechanism;^[4,5] however, an impairment in RPE function also plays a role.^[6] Kang *et al.*^[4] reported that the incidence of CME and NSD increases with the existence of retinal vascular hyperpermeability in diabetic eyes. Ota *et al.*^[7] reported the presence of discontinuity at the outer border of the detached retina in 9/28 eyes having NSD in DME. They speculated these discontinuities to represent a breakdown of barrier function of ELM.

In present study, we report the presence of outer retinal communications in eyes with NSD in DME. These communications are seen as defects in the outer border of the elevated retina, including ELM and photoreceptor layer. We also evaluated the significance of these communications in terms of their correlation with various factors. The size of the communication correlated positively with the vertical and horizontal size of NSD.

Though the exact significance of the detection of outer retinal communications is not known at present, it definitely helps to better understand the pathophysiology of NSD in DME. The correlation of the size of communications with the size of NSD is interesting and needs to be evaluated further. The limitations of the present study include small sample size and smaller subgroups-hence, the statistical values lack power or significance. Because of nonconsecutive selection of study eyes, the incidence of communications in eyes having NSD in DME cannot be predicted. Furthermore, correlation of the fundus fluorescein angiography findings was not done with the presence of communications. Hence, the role of ischemia causing RPE damage could not be evaluated. However, the primary aim of study is to report the presence of communications and their correlation with dimensions of NSD and BCVA.

Conclusions

It was concluded that the size of communication positively correlated with :

- The height of NSD ($r = 0.703$, $P = 0.002$)
- The horizontal diameter of NSD ($r = 0.685$, $P = 0.002$)
- logMAR BCVA ($r = 0.829$, $P < 0.0001$)

References

1. Ciulla TA, Amador AG, Zinman B. Diabetic retinopathy and diabetic macular edema: Pathophysiology, screening, and novel therapies. *Diabetes Care*. 2003;26:2653–64.
2. Otani T, Kishi S, Maruyama Y. Patterns of diabetic macular edema with optical coherence tomography. *Am J Ophthalmol*. 1999;127:688–93.
3. Al-latayfeh MM, Sun JK, Aiello LP. Ocular coherence tomography and diabetic eye disease. *Semin Ophthalmol*. 2010;25:192–7.
4. Kang SW, Park CY, Ham DI. The correlation between fluorescein angiographic and optical coherence tomographic features in clinically significant diabetic macular edema. *Am J Ophthalmol*. 2004;137:313–22.
5. Weinberg D, Jampol LM, Schatz H, Brady KD. Exudative retinal detachment following central and hemicentral retinal vein occlusions. *Arch Ophthalmol*. 1990;108:271–5.
6. Ravalico G, Battaglia Parodi M. Exudative retinal detachment subsequent to retinal vein occlusion. *Ophthalmologica*. 1992;205:77–82.

7. Ota M, Nishijima K, Sakamoto A, Murakami T, Takayama K, Horii T, et al. Optical coherence tomographic evaluation of foveal hard exudates in patients with diabetic maculopathy accompanying macular detachment. *Ophthalmology*. 2010;117:1996–2002.