Optical Coherence Tomography Findings of Diabetic Maculopathy in Egypt

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Authors’ contributions

This work was carried out in collaboration between all authors. Author GMA performed the statistical analysis and wrote the protocol. Authors GR and ME managed the analyses of the study. Author MMF managed the literature searches, designed the study and wrote the first draft of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aim of the Work: To evaluate the diagnostic function of Optical Coherence Tomography (OCT) in diabetic maculopathy and the most significant and common OCT findings.

Patients and Methods: This study was a prospective, non-comparative, non-interventional, case series, carried out between November 2015 to March 2017 and included 500 eyes of 287 diabetic patients with diabetic maculopathy. Their retinas were assessed and classified according to OCT findings of retinal thickness, retinal morphology, retinal topography, macular traction, and foveal photoreceptor status.

Results: OCT classification of the cases according to their retinal thickness showed that 18.8% of the cases had no macular edema, 21.8% had early subclinical macular edema and 59.4% had established macular edema. Regarding retinal morphology, OCT showed that 62.8% of the cases had simple non cystoids macular edema, 31.6% had early cystoid macular edema and 5.6% had serous macular detachment. 89.8% of the cases had no macular traction, 7.6% had questionable macular traction and 2.8% had definite macular traction. The retinal outer layers integrity showed that 94.4% of cases had intact inner segment/outer segment line (IS/OS) and external limiting membrane (ELM) and 5.6% had IS/OS and ELM with disrupted integrity.

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Conclusion: Our study concluded that OCT provided variable data about the thickness, morphology, topography, specific changes in the outer retina and the presence of VMT (vitreo-macular edema). Among patients at Sohag Governorate, Simple non cystoid macular edema was the most common finding with little incidence of VMT and affection of the outer retina.

Keywords: Optical coherence tomography; diabetic maculopathy.

1. INTRODUCTION

Diabetic macular edema (DME) is an accumulation of fluid within the central portion of the retina, due to failure of the blood-retinal barrier (BRB). Diffuse type is caused by extensive capillary leakage, whereas focal type is caused by focal leakage from grouped microaneurysms (MAs) and carries a better prognosis. DME can be considered as the major cause of visual impairment in diabetic patients as well as throughout the developed world. Fluorescein angiography (FA) and fundus photographs were the most commonly used tools in the diagnosis of DME in the past. The progress in imaging technology has gone parallel to the advances in understanding the pathogenesis and meticulous diagnosis of DME [1].

Optical coherence tomography (OCT) provides a qualitative and quantitative evaluations of structural changes in the macula affected by DME. The interest in using the criteria of clinically significant macular edema (CSME) decreased due to the emergence of OCT-based diagnosis. OCT images are now used in the diagnosis, treatment, and follow up of DME [2].

The central macular thickness is considered as the most important biomarker in diagnosis of DME by OCT. It shows moderate correlation with the functional outcomes. Other findings including presence of epiretinal membrane, vitreo-macular adhesion, disrupted inner retinal layers, abnormalities in the ellipsoid layer, and sensory neural detachment are considered integral part of diagnosis [3].

Spectral domain OCT (SD-OCT) is the most commonly used second-generation OCT providing high-resolution images with three-dimensional raster scans of up to a few hundred B-scans. It is more advanced than the previous generation time-domain (TD)-OCT that allowed imaging of 6 radial cuts only [1].

To the best of our knowledge, the exact prevalence of DME in Egypt is still unknown. The prevalence of diabetic retinopathy (DR) in a sample of Egyptian diabetics was 20.5% in 2011. Most of those patients were not minded by the risk of DR and the study did not include the OCT findings [4].

1.1 Aim of the Work

The aim of this study was to evaluate the diagnostic function of Optical Coherence Tomography (OCT) in diabetic maculopathy and the most significant and common OCT findings in diabetic maculopathy patients in Sohag governorate in Egypt.

2. PATIENTS AND METHODS

This study was a prospective, non-comparative, non-interventional, case series, carried out between November 2015 to March 2017 and included 500 patients’ retina of 287 patients with different stages of diabetic retinopathy, 115 males and 172 females. Their ages ranged from 20 to 80 years. They were attending the retina clinic of Sohag University Hospital. They were candidate for OCT. Ethical committee approval has been taken of this study.

The Inclusion criteria were all patients with diabetic maculopathy that attended the retina clinic in Sohag University Hospital. They were grouped and analyzed according to the OCT findings. Patients who were suffering from other retinal vascular diseases as retinal vein occlusion, retinal artery occlusion and retinal vasculitis were excluded from this study.

All patients were subjected to history taking, including; name, age, gender, duration of diabetes mellitus, type of medication for diabetes, associated systemic diseases (hypertension, renal and cardiac diseases), past history of ocular surgery or argon therapy and ocular medication.
Table 1. Koleva-Georgieva classification of diabetic Maculopathy according to OCT findings

<table>
<thead>
<tr>
<th>Item</th>
<th>Classification</th>
</tr>
</thead>
</table>
| 1) Retinal Thickness | • No macular edema.  
  • Early subclinical macular edema.  
  • Established macular edema. |
| 2) Retinal Morphology | • Simple non-cystoid macular edema.  
  • Cystoid macular edema (mild, intermediate and severe).  
  • Serous macular detachment. |
| 3) Retinal Topography | • Non-significant macular edema.  
  • Clinically significant macular edema. |
| 4) Presence and Severity of Macular Traction | • No macular traction  
  • Questionable macular traction  
  • Definite macular traction |
| 5) Retinal Outer Layers Integrity (IS/OS and ELM) | • IS/OS and ELM intact  
  • IS/OS and ELM with disrupted integrity |

All patients were examined and the following data were collected and recorded: visual acuity (un-corrected and best corrected) by Snellen chart, anterior segment examination by slit lamp biomicroscopy (Slit Lamp SL-250, Nidek Inc., Tokyo, Japan), intraocular pressure (IOP) measurement by applanation tonometry and fundus examination by indirect ophthalmoscopy (Keeler All Pupil II LED Slimline Wireless) and slit lamp biomicroscopy. All patients were examined also by Spectral Domain SD-OCT (Topcon 3D 2000; Topcon Inc., Tokyo, Japan) and fluorescein angiography and the stage of diabetic retinopathy and type of diabetic maculopathy were reported. The main outcomes were the findings obtained from OCT.

Patients retina were assessed and classified according to OCT findings of retinal thickness, retinal morphology, retinal topography, macular traction, and foveal photoreceptor status. This classification was described by Koleva-Georgieva and Sivkova [5] and summarized in Table 1.

2.1 Statistical Analysis

Data collected and analyzed by computer program SPSS ver.17 Chicago, USA. Data expressed as mean, standard deviation and number percentage. T-test test used to determine significance for numeric variable. Chi. Square was used to determine significance for categorical variable. P value < 0.05 was considered significant.

3. RESULTS

This study included 500 eyes of 287 patients with different stages of diabetic retinopathy, 115 males (40.07%) and 172 females (59.93%). Their ages ranged from 20 to 80 years, with mean age 55.98 and standard deviation ± 9.81.

Diabetic Maculopathy cases classified according to diabetic retinopathy stages and then grouped according to the type of maculopathy into diabetic macular edema, macular ischemia and mixed cases. Table 2 and Fig. 1 show a relationship between stages of diabetic retinopathy and types of maculopathy. Regarding previous argon laser treatment, 7.4 % of diabetic maculopathy cases had previous eye laser. On the other hand 92.6% not exposed to previous eye laser.

As discussed before, From the 500 cases of diabetic maculopathy, 286 of them had macular edema, 94 cases had macular ischemia only and 120 cases had mixed maculopathy. OCT classification of the cases according to their retinal thickness showed that (18.8%) of the cases had no macular edema, (21.8%) had early subclinical macular edema and (59.4%) had established macular edema.

Regarding retinal morphology, OCT showed that (62.8%) of the cases had simple non cystoids macular edema, (31.6%) had early cystoids macular edema and (5.6%) had serous macular detachment.
According to retinal topography, OCT findings showed that (73.6%) of the cases had clinically significant macular edema and (26.4%) had non-clinically significant macular edema.

The results of OCT according to the presence and severity of macular traction showed that (89.8%) of the cases had no macular traction (presence of complete posterior vitreous detachment (PVD), or no PVD and no epiretinal membrane), (7.6%) had questionable macular traction (incomplete PVD with perifoveal or peripapillary adhesion and/or globally adherent ERM without detectable distortion of retinal surface contour at the points of adhesion) and (2.8%) had definite macular traction (traction with incomplete PVD with perifoveal adhesion and/or focal ERM with detectable distortion of retinal contour at the points of adhesion).

Lastly, the retinal outer layers integrity showed that (94.4%) of cases had intact IS/OS and ELM and (5.6%) had IS/OS and ELM with disrupted integrity. All these data are summarized in Table

3. DISCUSSION

Our study described the variable OCT findings in cases with diabetic maculopathy in the locality of Sohag Governorate (Egypt). Established macular edema was detected in more than half of the cases. Regarding the morphology, more than half of the cases were simple non-cystoid macular edema and more than two thirds of cases had CSME.

Macular traction was not a common finding and about 90 % of cases did not show any OCT evidence of traction. Akbar Khan et al, investigated 198 cases of DME by OCT to detect the presence of vitreo-macular traction (VMT) which was evident in 25 % of cases [6]. These results were slightly different from our series where VMT was detected in 10% of cases only. Another study in Nepal, showed that the incidence of VMT detected by OCT in DME was
Table 3. Diabetic macular edema according to the OCT findings

<table>
<thead>
<tr>
<th>OCT Findings</th>
<th>Number (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retinal Thickness:</td>
<td></td>
</tr>
<tr>
<td>(1) No macular edema</td>
<td>94 (18.8%)</td>
</tr>
<tr>
<td>(2) Early subclinical macular edema</td>
<td>109 (21.8%)</td>
</tr>
<tr>
<td>(3) Established macular edema</td>
<td>297 (59.4%)</td>
</tr>
<tr>
<td>Retinal Morphology</td>
<td></td>
</tr>
<tr>
<td>(1) Simple non cystoid macular edema</td>
<td>314 (62.8%)</td>
</tr>
<tr>
<td>(2) Cystoid macular edema</td>
<td>158 (31.6%)</td>
</tr>
<tr>
<td>(3) Serous macular detachment</td>
<td>28 (5.6%)</td>
</tr>
<tr>
<td>Retinal Topography</td>
<td></td>
</tr>
<tr>
<td>(1) Non significant macular edema</td>
<td>132 (26.4%)</td>
</tr>
<tr>
<td>(2) Clinically significant macular edema</td>
<td>368 (73.6%)</td>
</tr>
<tr>
<td>Presence and Severity of Macular Traction</td>
<td></td>
</tr>
<tr>
<td>(1) No macular traction</td>
<td>448 (89.6%)</td>
</tr>
<tr>
<td>(2) Questionable macular traction</td>
<td>38 (7.6%)</td>
</tr>
<tr>
<td>(3) Definite macular traction</td>
<td>14 (2.8%)</td>
</tr>
<tr>
<td>Retinal Outer Layers Integrity (IS/OS and ELM)</td>
<td></td>
</tr>
<tr>
<td>(1) IS/OS and ELM intact</td>
<td>472 (94.4%)</td>
</tr>
<tr>
<td>(2) IS/OS and ELM with disrupted integrity</td>
<td>28 (5.6%)</td>
</tr>
</tbody>
</table>

just 5.8% [7]. These variations among different studies may be due to the variation in the locality and ethnic groups.

The outer retinal layers were intact in most of the cases but were affected in the form of disrupted integrity of the IS/OS line and ELM in 5.6% of cases only. These changes were important factors affecting the best corrected visual acuity in DME patients as reported in a study by Uji et al [8]. They also reported the presence of hyperreflective foci in the outer retina which were not reported in our study [8].

In the present study, pure macular ischemia was found in 18.8% of the cases. There was a direct relationship between the macular ischemia and both retinopathy stage and duration of the diabetes. These finding are in agreement with Conrath J et al., who mentioned that the size of foveal avascular zone increased with the more advanced stage of retinopathy and duration of diabetes [9].

Fig. 2. A case of diabetic maculopathy with thin epiretinal membrane that is separated from the retinal surface in multiple areas causing distortion to the inner retinal layers and flattening of the central foveal depression
In the literature, contradictory data was presented on the role of the two imaging methods, OCT and FA, in the detection of diabetic maculopathy. Our study did not provide a definitive answer to this issue. Nevertheless, at the present time it seems that OCT cannot replace FA in this regard. FA enables the evaluation of foveal perfusion, which, according to our study, could not be predicted based on OCT.

4. CONCLUSION

Our study concluded that OCT provides variable data about the thickness, morphology, topography, specific changes in the outer retina and the presence of VMT in cases of DME. Among patients at Sohag Governorate, Simple non cystoid macular edema was the most common finding with little incidence of VMT and affection of the outer retina.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the author(s).

ETHICAL APPROVAL

Ethical committee approval has been taken of this study.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES


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