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Research Article

Supremacy of Optical Coherence Tomography Angiography Over Conventional Imaging in Detecting Occult Quiescent Macular Neovascularization

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Abstract

Age-related macular degeneration (AMD) is a leading cause of blindness in elderly population. The primary cause of blindness is macular neovascularisation (MNV) and atrophy that occur during the disease progression. Differential diagnosis of neovascular subtypes in AMD is important for predicting therapeutic response and prognosis. Imaging plays an essential role in the diagnosis and treatment guidelines of neovascular AMD. Optical coherence tomography angiography (OCTA) is a new, non-invasive imaging technique that generates volumetric angiography images in a matter of seconds and can be helpful in detecting occult MNV in early stages, which is rather difficult with conventionally available imaging. This case depicts one such situation.

Keywords: Age-related Macular Degeneration (AMD); Macular NeoVascularisation (MNV); Optical Coherence Tomography Angiography (OCTA)

Introduction

Age-related macular degeneration (AMD) is the leading cause of blindness in elderly population today. The primary cause of blindness is macular neovascularisation (MNV) and atrophy that occur during the disease progression. In AMD, the neovascularization can start in the outer retina, and so the term choroidal neovascularization is not appropriate for the class and has been replaced by the new nomenclature as MNV [1].

Neovascularization Subtypes: [1]

- Type 1 MNV- Ingrowth of new vessels initially from the choriocapillaris into and within the sub-RPE space, leading to varying types of PEDs.
- Type 2 MNV- Neovascularization originating from the choroid, traverses Bruch's membrane and the RPE monolayer and then proliferates in the subretinal space.
- Type 3 MNV- Neovascularization originating from the deep capillary plexus of retinal circulation, and growing toward the outer retina.

Differential diagnosis of neovascular subtypes in AMD is important for predicting therapeutic response and prognosis. Imaging plays an essential role in the diagnosis and treatment guidelines of neovascular AMD. Previously, fluorescein angiography (FA) was considered the gold standard to the differentiate lesion subtype and provide information about the activity through the dynamic visualization of leakage of dye [2]. Recently with the advances in optical coherence tomography angiography (OCTA), the visualisation of the retina and choroid lesions has improved immensely, allowing more precise details with localisation of MNV. Type 1 MNV is observed by OCTA as a neovascular coralliform complex with afferent vessel, originating in the choroid. Type 2 MNV is visualized as a neovascular network that grows from the choroid vasculature traverses the RPE-Bruch's membrane complex into the subretinal space. Type 3 MNV is clinically seen as tiny intra- and subretinal hemorrhages that correlate on OCTA to an intraretinal anastomosis originating in the deep capillary plexus of the retina [3].

Case Report

We report a case of 71 year old female who presented with 2 month history of metamorphopsia in the left eye. On examination the best corrected visual acuity in RE and LE was 20/20 and 20/40. On dilated fundus examination, left eye showed a yellowish elevated macular lesion, other eye being completely normal. The OCT showed an elevated area of retinal pigment epithelium (PED: Pigment epithelium detachment) with heterogeneous reflectivity, which corresponded to the macular lesion which was seen on fundus examination. The OCTA showed a network of new vessels in ORCC slab which corresponds to the OCT B-scan.

Thus, the OCTA helped us to detect the small neovascularisation frown under the PED which denoted a Type 1 MNV in the early phase of the disease. Treatment started with intravitreal anti-VEGF injections in this phase can help in maintaining visual acuity for a longer span of time.

Discussion

OCTA is a new non-invasive imaging technique that employs motion contrast imaging to high-resolution volumetric blood flow information generating angiographic images in a matter of seconds without the use of dye. The software compares the phase variance between consecutive OCT B scans acquired at the same cross section to detect motion contrast and differences represent movement of red blood cells within the vessels. From multiple retinal cross sections, a retinal map can be constructed. This allows simultaneous evaluation of retinal blood flow pattern and structural information. OCT angiograms can be segmented by automation or manually into different layers to evaluate different vascular layer separately. The en-face images (OCT angiograms) from the internal limiting membrane (ILM) to the choroid visualize the individual vascular plexus and segment the inner retina, outer retina, choriocapillaris, or other area of interest [4].

The characteristic finding in different subtype of MNV on spectral OCT and OCTA-

- Type 1 MNV represents areas of neovascular complexes arising from the choroid and imaged with OCT as an elevation of the RPE by material with heterogeneous reflectivity. OCT angiography shows vessels below the level of the RPE.
- Type 2 MNV represents areas of neovascular complex located in the subretinal space, above the level of the RPE. Associated with subretinal hyperreflective material and separation of the neurosensory retina from the RPE. OCT angiography demonstrates vascular elements above the level of the RPE.
- Type 3 MNV represents extension of hyperreflectivity from the middle retina toward the level of the RPE associated with intraretinal edema, hemorrhage, and telangiectasis. OCT angiography shows the down growth of new vessels toward or even penetrating the level of the RPE.

OCTA cannot truly detect the leakage, but gives the flow information at a fixed point in time. This helps in detecting the size and activity of the MNV. This is especially useful for identification of type 1 MNV where localization is inferential and therefore may be inaccurate with FA/ICGA [3,4].

Accurate diagnosis of MNV is important, as treatment outcomes may depend on the subtype. Out of all the subtypes, eyes with type 1 MNV have been reported to be more likely to maintain vision over time, despite requiring more frequent anti-VEGF injections Moreover, type 1 lesions had 6.7 times less risk of developing GA than eyes with other lesion subtypes. OCTA can be used for monitoring the treatment response as well which helps on deciding the further treatment regimen [5].

FA can be considered in assessing MNV activity through the dynamic visualization of dye leakage. Despite its advantages, it does have several drawbacks: first, it is a time-consuming and invasive procedure in which fluorescein dye is injected intra-venously. Second, the dye used for the procedure does not allow a good visualization of the choroidal circulation and is hindered by fluid, blood, and lipids. Third, there are known systemic side effects of the dye which is excreted from the body through kidney and cannot be used in patients with deranged kidney function test [4,5].

Correct assessment of the MNV type with the help of OCTA can give information on a patient's prognosis and helps to determine the preferred treatment regimen.

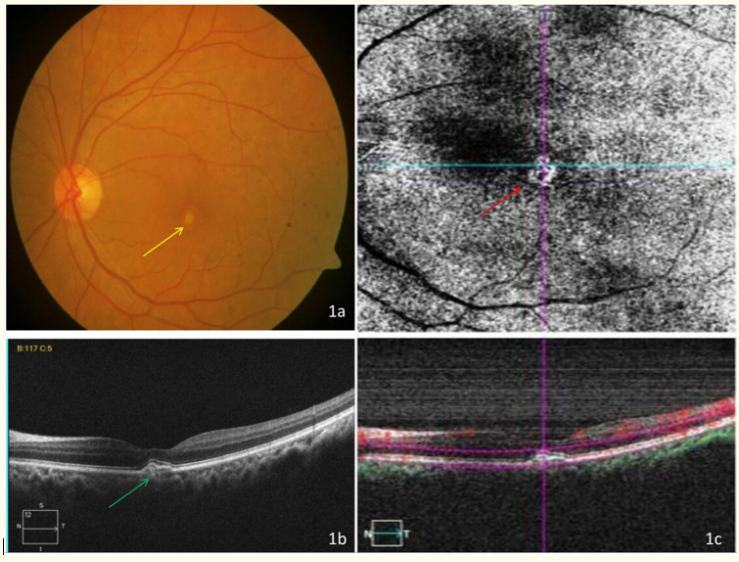

Figure 1: 1a- Fundus photo showing hypopigmented yellow macular lesion (yellow arrow).
1b- OCT scan showing a pigment epithelial detachment with underlying heterogenous reflectivity (green arrow).
1c- OCTA image showing a network of new vessels in ORCC slab (red arrow) which correlates with the OCT B scan.

Conclusion

Subtle membranes like Type 1 MNV can be picked up in early stages non-invasively with the OCTA, which helps in disease management and monitoring.

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