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Original article

Analysis and follow-up of type 1 choroidal neovascularisation with optical coherence tomography–angiography after antiangiogenic treatment☆

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ABSTRACT

Aim: To describe the characteristics of type 1 choroidal neovascularisation (CNV) in age-related macular degeneration (ARMD) using two different optical coherence tomography angiography (OCT-A) devices sequentially during a standard protocol of three intravitreal injections of an anti-vascular endothelial growth factor (anti-VEGF).

Methods: The study included 6 eyes with naïve neovascular ARMD. Macular OCT-A images were acquired using AngioPlex Cirrus HD-OCT 5000 (Carl Zeiss Meditec, Inc., Dublin, USA) and DRI OCT Triton SS-OCT Angio (Topcon, Medical Systems, Inc., Oakland, NJ, USA). The macular OCT-A scan covered an area of 3 mm × 3 mm. Distinct morphological patterns and quantifiable features of the neovascular membranes were studied on *en face* projection images, which were taken at different stages of the follow-up.

Results: Treatment response could be estimated using the OCT-A criteria of CNV activity. Higher activity scores before treatment resulted in a greater decrease in the membrane area. The estimated net decline in area ranged from 83.5% to 1.4%. The OCT-A performed one-week after treatment revealed the greatest area reductions.

Conclusions: OCT-A provides new possibilities for the non-invasive assessment of features of neovascular networks and CNV structural morphology. Newly described activity criteria can also guide therapeutic decisions, and help in evaluating responses. Quantitative and qualitative information can be provided with this technique. However, further software development and future investigation are essential to define the role of this tool on a daily basis.

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Análisis y seguimiento con angiografía por tomografía de coherencia óptica de neovascularización coroidea tipo 1 en degeneración macular tras tratamiento antiangiogénico

Palabras clave:
Neovascularización coroidea
Angiografía por tomografía de coherencia óptica
Degeneración macular asociada a la edad
Antifactor de crecimiento vascular endotelial
Diagnóstico por imagen

RESUMEN

Objetivo: Describir las características de la neovascularización coroidea (NVC) tipo 1 en pacientes con degeneración macular asociada a la edad (DMAE), utilizando la angiografía por tomografía de coherencia óptica (A-OCT) secuencialmente durante el transcurso de un protocolo estándar de 3 inyecciones intravítreas de fármaco anti-VEGF.

Métodos: Seis ojos con DMAE neovascular no tratados previamente fueron incluidos. Se obtuvieron imágenes por A-OCT empleando AngioPlex Cirrus HD-OCT 5000 (Carl Zeiss Meditec, Inc., Dublin, EE. UU.) y DRI OCT Triton SS-OCT Angio (Topcon, Medical Systems, Inc. Oakland, NJ, EE. UU.). El área estudiada comprende un escáner macular de 3×3 mm. Diferentes patrones morfológicos y aspectos cuantificables de las membranas neovasculares han sido evaluados con imágenes en proyección *en face*, que fueron tomadas en distintos tiempos del seguimiento de los pacientes.

Resultados: El grado de respuesta al tratamiento fue estimado empleando criterios de actividad de NVC para A-OCT. Puntuaciones más altas en los ítems de actividad antes del tratamiento resultaron en mayores reducciones del área de las membranas. Los resultados finales de reducción de área oscilaron entre el 83,5 y el 1,4%. Las A-OCT realizadas a la semana de tratamiento revelaron los mayores porcentajes de reducción.

Conclusiones: La A-OCT ofrece la posibilidad de analizar en profundidad las características morfológicas y estructurales en NVC de tipo 1. Los criterios de actividad permiten guiar decisiones terapéuticas y evaluar la respuesta al tratamiento. Con esta técnica puede obtenerse información útil tanto cualitativa como cuantitativa. Sin embargo, son necesarios avances en el desarrollo del software y en investigación para poder definir el papel de esta herramienta en la práctica diaria.

Introduction

Since the 60s, the visualization of the retinal and choroidal vascular network was based on 2 main techniques: Fluorescein angiography (FAG) and indocyanine green angiography (ICG).[1] Both techniques allow the observer to watch vessels filling up in real-time and to determine contrast leak and the time when it occurs. Fluorescein patterns in ARMD have enabled the characterization of neovascular proliferative lesions and facilitated the understanding of the disease.[2,3] As described by Gass,[4] classic CNV (CNV type 2) is characterized by well-defined hyperfluorescence in early FAG stages with extravasation in late stages that masks lesion edges. Hidden CNV (CNV type 1) is defined by a regular elevation of the retina pigment epithelium (RPE) with dotted hyperfluorescence occurring 1–2 min after fluorescein injection and diffuse extravasation in the final phase. For this reason, the distortion of the image that produces contrast extravasation, particularly in late stages, makes it difficult to adequately characterize these structures.

With the appearance of spectral domain optical coherence tomography (SD-OCT), the activity or quiescence of neovascular membranes type 1 has been calculated on the basis of indirect parameters such as RPE smoothness, reflectiveness of the space underlying the RPE and the presence of subretinal hypo-reflective material corresponding to subretinal fluid (SRF) exudation which, together with the presence of intraretinal liquid, has traditionally determined the decision to treat.[5] Unfortunately, this technique is unable to discriminate an active neovascular network from other adjacent tissue as well as fibrotic scars or drusenoid RPE detachments.[1,6]

OCT angiography (A-OCT) is a novel diagnostic imaging technique that, without being invasive, enables the characterization of retinal blood flow and visualization of the vascular network. To this end, it applies phase or amplitude decorrelation technology that is able to detect the movement of erythrocytes that occurs between successive B-scan sections generated by OCT.[7–9] The majority of the algorithms applied by A-OCT are based on amplitude decorrelation as it does not require complex phase correction methods and exhibits an improved signal-noise ratio. The most widely used algorithm is split spectrum amplitude decorrelation angiography (SSADA). The end results are high resolution 3-D images enabling a volumetric angiographic analysis of retinal layers in combination with the structural analysis provided by OCT.[10,11]

The objective of this study is to describe the vascular network of neovascular lesions, inferring the response to treatment on the basis of quantitative parameters and to sequentially quantify A-OCT changes after treatment with anti-VEGF.