



University of Mississippi Health Care
UNIVERSITY
PHYSICIANS

Evaluating the Response of Type 1 Choroidal Neovascular Membrane in Neovascular Age-Related Macular Degeneration to Anti-VEGF Treatment by Optical Coherence Tomography Angiography

Ching J. Chen, MD, Matthew Olson, CRA, Brian Tieu, MD, Jordan Burnham, MD
Department of Ophthalmology, University of Mississippi Medical Center



Corresponding Author:
Ching J. Chen, MD
E-mail: cchen@umc.edu

Objective:

To observe the vascular response to anti-VEGF treatment in neovascular ARMD with type 1 CNV by OCT angiography (OCTA)

Design:

Consecutive observational case series

Material and Methods:

Retrospective review of SSADA based OCTA on patients received anti-VEGF treatment in neovascular ARMD with type 1 CNV. A standard FA was obtained by a digital camera angiography. OCT images obtained by a 70 KHz wide angle Spectral Domain (SD)-OCT system with Optovue Avanti RTVue XR SD-OCT (Fremont, CA), and OCTA images captured by the same SD-OCT equipment with the light source of 840nm were reviewed. The AngioVue and AngioAnalytics software were used to detect and calculate the flow of the CNVs in both 3x3mm and 6x6mm areas. Motion correction processing was applied while each scan was obtained. The 3D angiography was reviewed and segmented with the default setting of superficial retinal, deep retinal, outer retinal and choroid capillary slabs. Manual segmentation to adjust the segmentation plan was applied whenever needed.

Results:

37 eyes with type 1 CNV were treated with various anti-VEGF agents. Among them, 10 remained partially active and 7 were refractory to treatment. 10 were responsive with temporary inactive, and 10 had permanent remission after treatment. The OCTA detected blood flow in all types of CNV. In active CNV, the size and vascular volume of CNV varied. The size of CNV was smaller in active and temporary inactive CNVs than in refractory CNVs. The CNV responded to anti-VEGF treatment by partial closure of peripheral vascular branches, but the main central core vascular trunk remained unaffected. Recurrent activity also involved mainly the periphery. In refractory CNV, weekly OCTA showed none to minimal vascular responses. In quiescent CNV, flow change analysis showed a steady vascular flow pattern without changes.

Active CNV (10 eyes): Treated and partially active CNV, FA showed leakage, OCT showed intra- or sub-retinal fluid
Refractory CNV (7eyes) Refractory to monthly treatment with persistent exudation, FA showed persistent leakage and OCT showed intra- or subretinal fluid, frequently with RPED
Treated CNV with short term remission (10 eyes): Temporally respond to intraocular anti-VEGF treatment without exudation
Treated CNV with long term remission (10eyes): Treated and remain symptomless without leakage for greater than one year

Table 1: Types of vascular response to anti-VEGF treatment

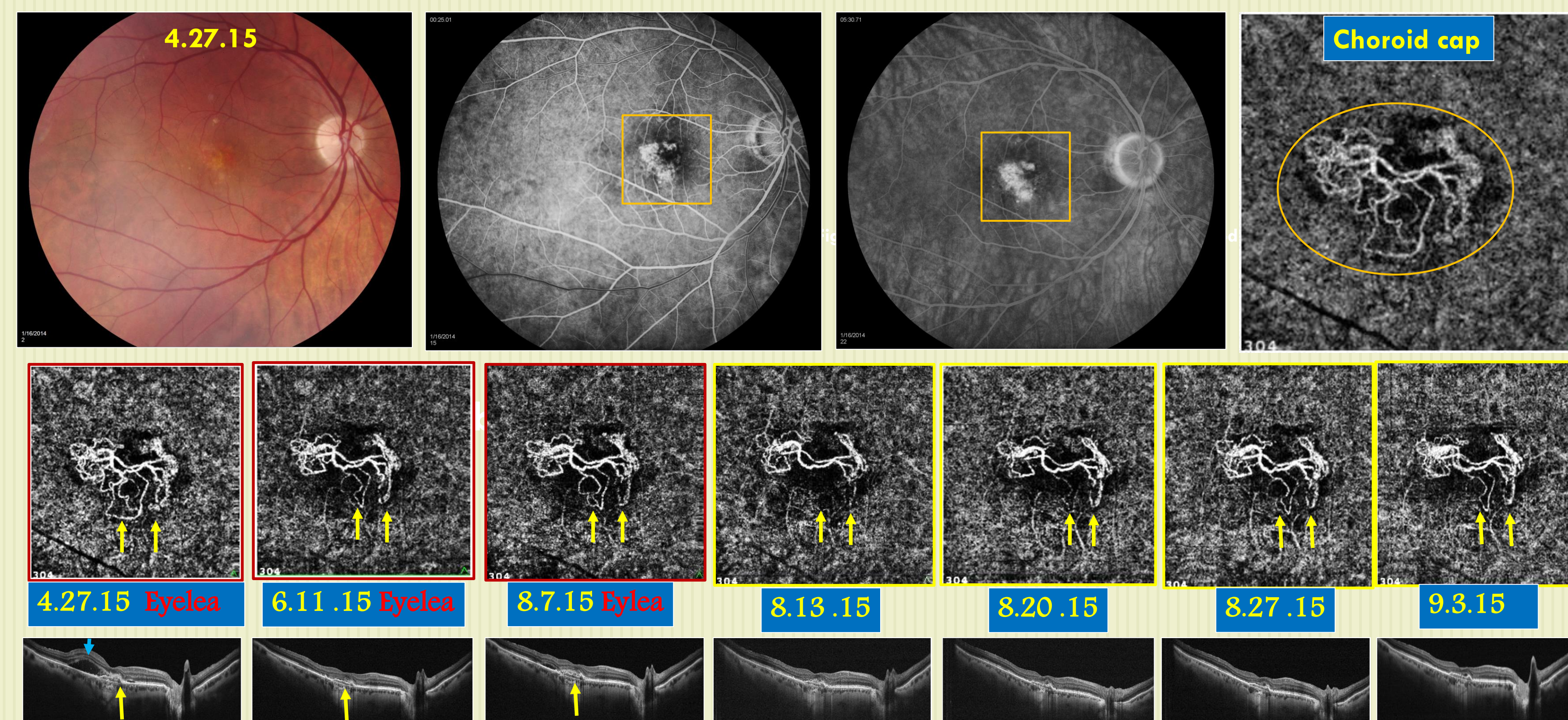


Fig. 1. Treated and active CNV; Color fundus photo, FA, OCT and Choroidal capillary slab of OCT angiography and weekly flow change analysis after IO Aflibercept injection.

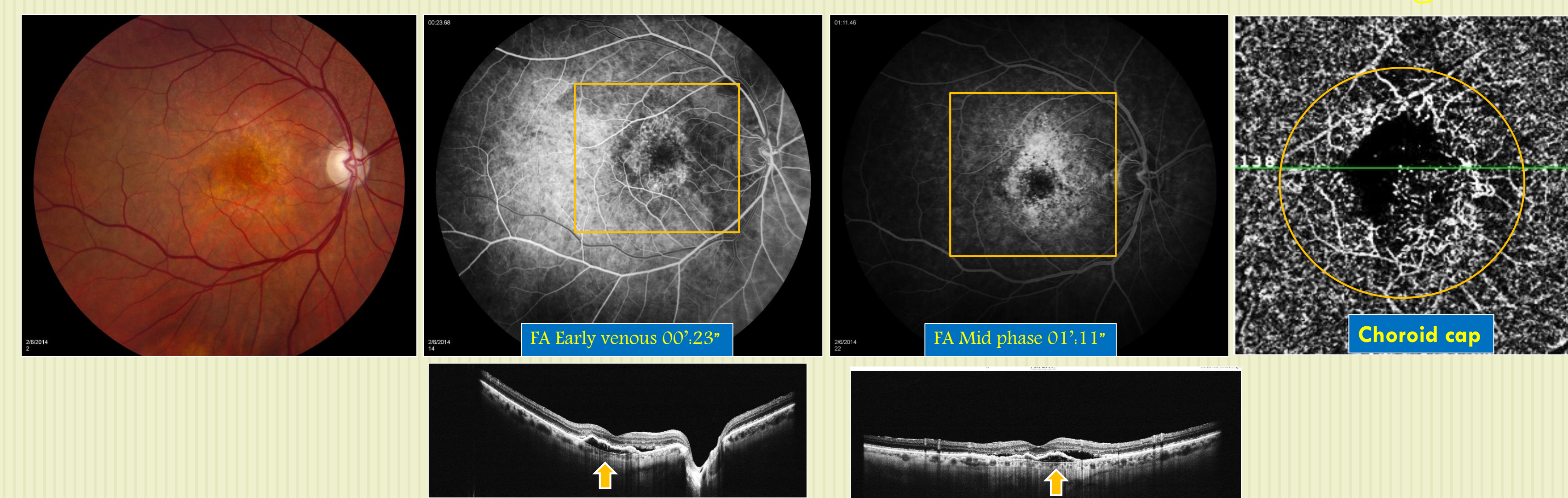


Fig. 2. Refractory type 1 CNV in spite of continuous multiple intraocular injection of Eylea for more than 2yrs. Color FP, FA, OCT and Choroidal capillary slab of OCT angiography and weekly flow change analysis (8 scans on the right) after IO Aflibercept injection.

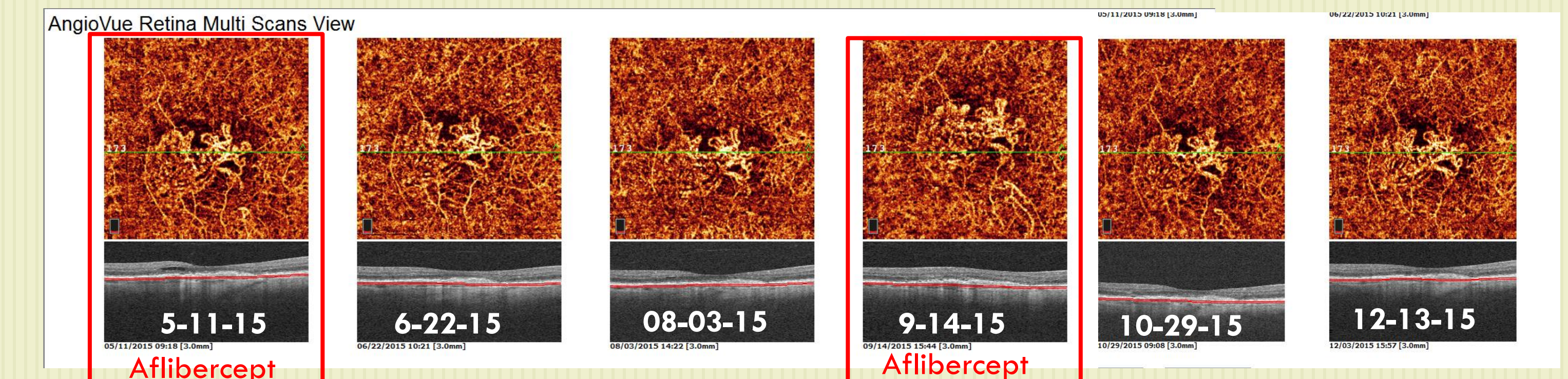
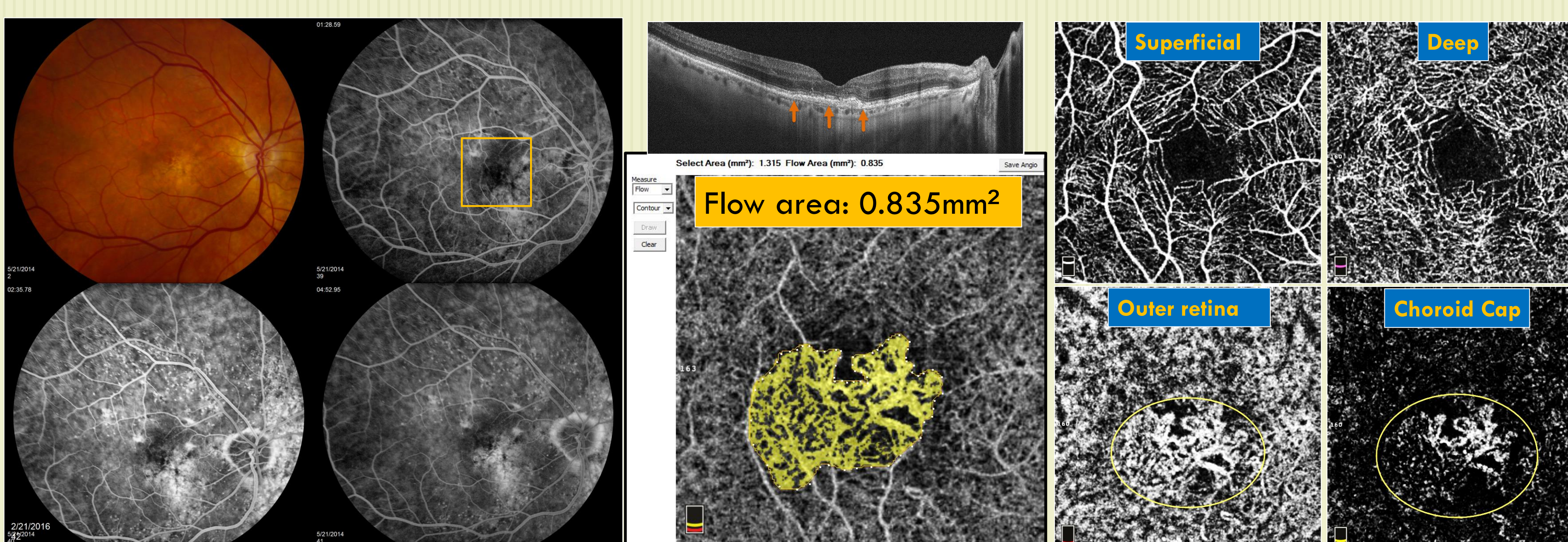


Fig. 3. Type 1 CNV responded to "Treat and Extend" treatment regimen, and temporally become inactive. FP, FA, OCT, OCTA, CNV flow density calculation are shown in first part of the figure. Flow change analysis are demonstrated above.

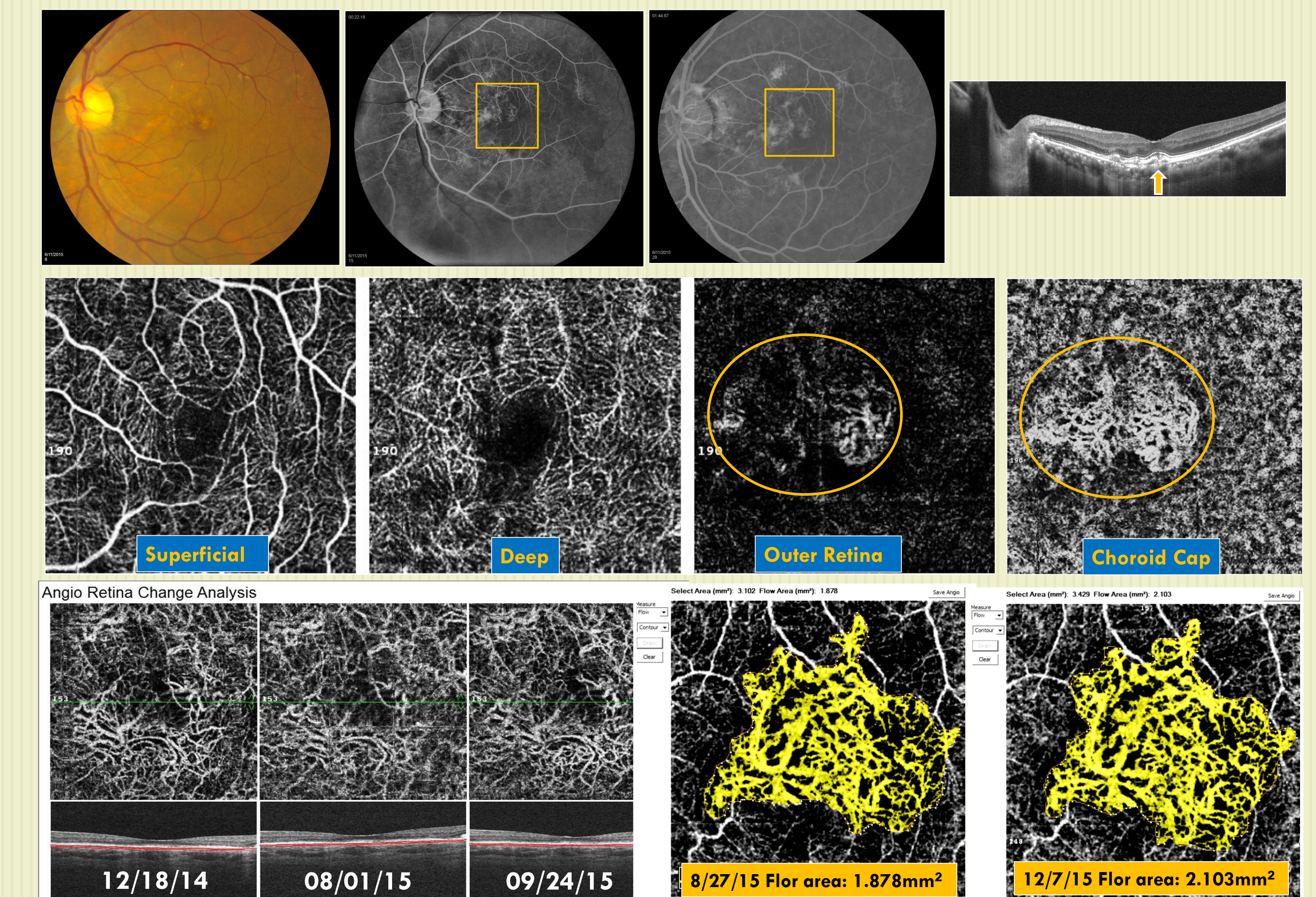


Fig. 4. Treated type 1 CNV with remission: No I.O. injection for >3 years. FA shows no leakage of dye. OCT shows CNV but without fluid. OCTA confirms a type 1 CNV at outer retinal and choroid capillary slabs. Flow change analysis of a different patient shows no significant flow change. Calculation of flow density in the other patient does show minor change.

Conclusion:

Anti-VEGF treated Type 1 CNVs can be divided into exudative and non-exudative subtypes. Non-exudative type are inactive CNVs. They respond to the treatment with short term or long term remission. Exudative type CNVs are active. They may respond temporally or protractedly refractory to the treatment. Blood flow is detected by OCTA in all types of CNV after treatment. The size and flow density of CNV appear to be smaller in short term remission type and active type CNVs than refractory type CNV. Vascular response to anti-VEGF treatment appears to occur from the branch of CNV with closure of peripheral vessels but main vascular trunk remains unchanged. Recurrent activity of CNV also occurs from the peripheral branches. Multi-mode imaging including SD-OCT and OCTA may be the best way to evaluate the vascular changes after treatment in neovascular ARMD.

Financial interest disclosure:

Ching J. Chen, MD: Consultant: Optovue, Clinical advisory board: Allergan. Speaker: Alcon International, Clinico
Matthew Olson, CRA, Brian Tieu, Jordan Burnham MD: No financial interest to be disclosed