Optical Coherence Tomography Angiography features of active inflammatory choroidal neovascularization in posterior uveitis and follow up after anti-VEGF therapy

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Background: Choroidal neovascularization (CNV) is an important complication of choroiditis. However, these lesions are often difficult to detect clinically and conventional dye-base angiography and other multimodal imaging such as optical coherence tomography (OCT) may be inconclusive in diagnosing these neovascular membranes due to presence of concomitant active and healed choroiditis lesions with associated scarring making the diagnosis of this condition a major challenge. Using OCTA, neovascular lesions have not been previously characterized in terms of features that denote activity and warrant anti-VEGF therapy.

Aim: To describe the OCTA characteristics of neovascular complexes in patients with multifocal/serpiginous choroiditis and correlation with multimodal imaging as well as response to anti-VEGF therapy on sequential imaging.

Patients & Methods: 16 eyes (11 patients; 7 females; mean age: 30.64 ± 13 years) with a diagnosis of posterior uveitis (tubercular multifocal serpiginoid choroiditis (5), multifocal choroiditis with panuveitis (3), punctate inner choroidopathy (1) Vogt-Koyanagi-Harada syndrome (1) and multifocal choroiditis(1) were included. Multimodal imaging was performed using optical coherence tomography angiography (OCTA), enhanced-depth imaging optical coherence tomography (EDI-OCT), fluorescein angiography (FA) and indocyanine green angiography (ICGA). Two trained graders on OCTA images evaluated morphological features of CNV, and their serial response to anti-VEGF therapy.

Results: 16 eyes with inflammatory CNV were treated with a mean of 2.52 ± 2 injections of 0.5 mg ranibizumab. The mean follow-up duration was 21.36 ± 25.3 months. Based on the appearance on imaging, the lesions were subdivided into type 1 & type 2 CNV.

OCTA features of Type 1 CNV and correlation with multimodal imaging

Six eyes of 5 patients had type 1 CNV. The mean pre-injection BCVA for all the eyes with type 1 CNV was 0.3±0.08. Post-injection BCVA improved to 0.21±0.09 (p=0.23).

***En face* OCTA showed type 1 inflammatory CNV *with fine anastomotic network, some of which had a hairpin loop configuration surrounding an area of choriocapillaris flow deficit*.**

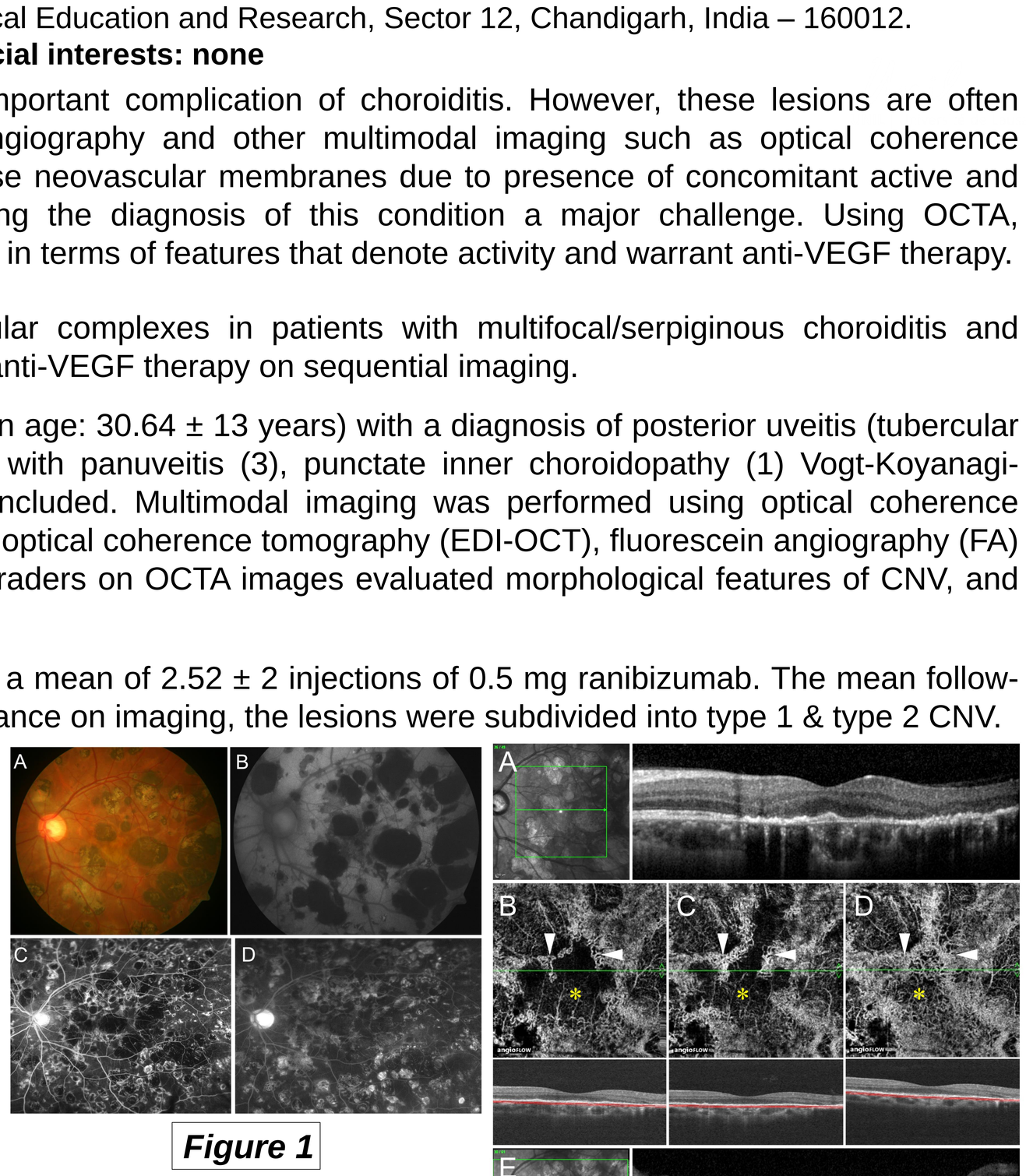

Figure 1

Figure1: (Patient #1) Diagnostic challenges in detection of type 1 CNV using routine imaging. (A) Fundus photograph of left eye shows apparently healed TB MSC. (B) FAF shows the presence of predominantly hypo-autofluorescent lesions suggestive of grade 4 healed lesions. Early phase FA shows staining of choroiditis scars (C) while the late phase shows mild leakage suggestive of low grade activity. However, there is no discernable feature suggestive of underlying CNV.

Figure 2: (Patient #1): Multimodal imaging of type 1 CNV. (A) Baseline OCT through the macula of the left eye shows subfoveal low lying PED with absence of fluid. There is disruption of the ONL, ELM and ellipsoid zone. (B) OCTA *en face* scan shows a fine anastomotic network of vessels surrounding an area of choriocapillaris flow deficit (yellow asterisk) with hairpin loop configuration (white arrowheads). (C) 10 days following intravitreal ranibizumab, there is a decrease in the anastomotic branching as well as the hairpin loop configuration with increase in the flow deficit areas. (D) At 2 months, these is significant shriveling of CNV with restitution of the choriocapillaris flow deficit areas indicating a healing response. (E) Follow-up OCT at 2 months shows resolution of the low lying PED with improvement in visual acuity from 20/100 at baseline to 20/30. (F, G and H) The structural *en face* OCTA scans reveal no significant signal loss at any stage indicating true choriocapillaris flow deficit.

Figure 2

OCTA Features of Type 2 CNV and correlation with multimodal imaging

10 eyes of 7 patients showed the presence of type 2 CNV. The mean BCVA at baseline (pre-injection) for all the eyes with type 2 inflammatory CNV was 0.59±0.35. Post-injection BCVA improved to 0.29±0.29 (p = 0.03)

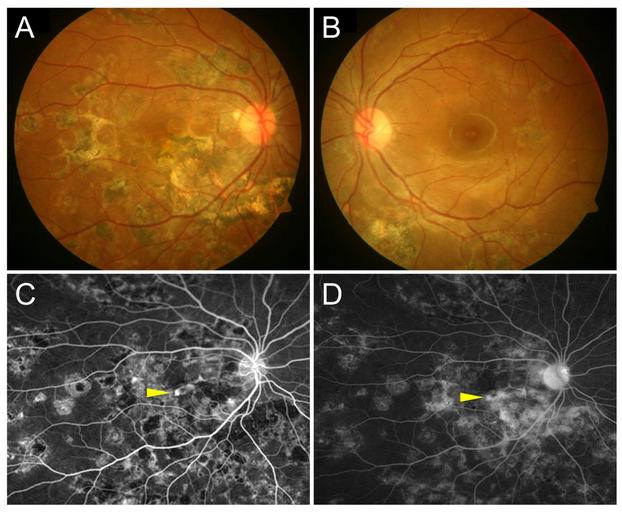

Figure 3

Figure 3: (Patient #2): Detection of type 2 CNV on FA. Fundus photograph of the right eye shows healed TB MSC lesions in the right eye (A) and the left eye (B). FA of the right eye shows early hyperfluorescent lesion in the foveal region (yellow arrowhead) (C). Late phase FA shows progressive hyperfluorescence of the foveal lesion suggestive of CNV (yellow arrowhead) with staining of the healed choroiditis lesions (D).

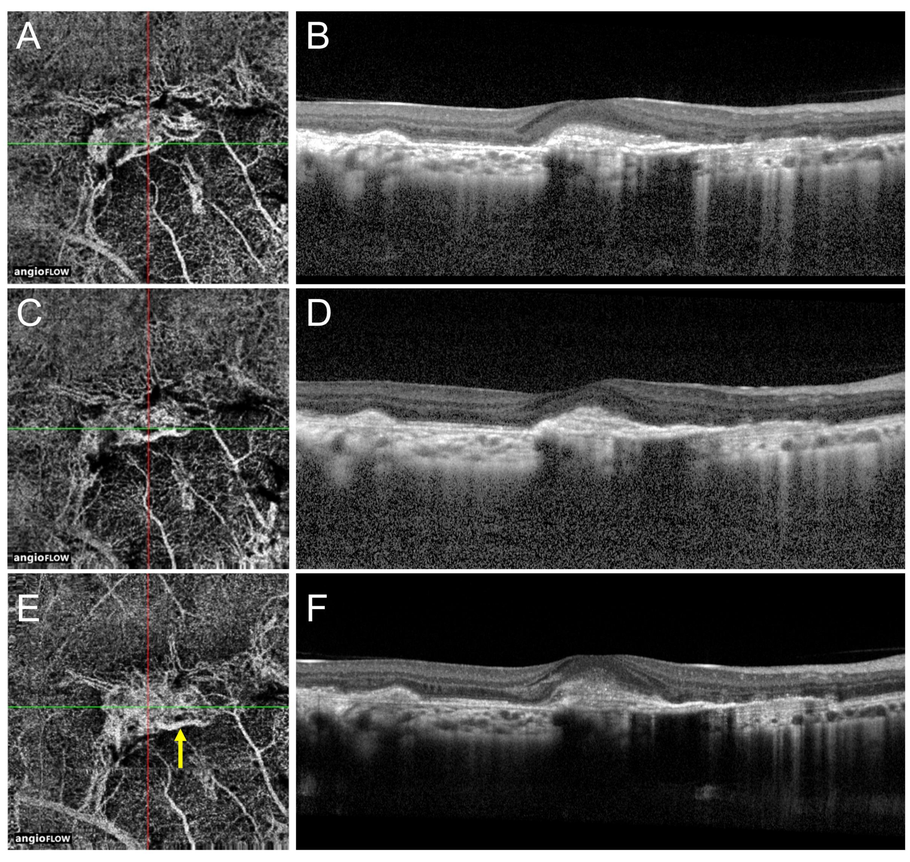

Figure 4

On en face OCTA, type 2 CNV were visible in all eyes as branched vascular network extending to the outer retinal slab from the choriocapillaris layer. The morphologies of the CNV varied from medusa head to sea-fan appearance.

Figure 4: (Patient #2): Serial multimodal imaging in a case of healed TB MSC with type 2 CNV. (A) OCTA *en face* shows presence of a thick network of vessels in the center surrounded by a finer network of anastomotic vessels. (B) OCT passing through the macula in the right eye shows presence of hyper-reflectivity in the outer retina with slight elevation of the underlying RPE suggestive of a type 2 CNV with blunting of the foveal contour without any fluid spaces. (C) OCTA en face at 7 weeks after intravitreal ranibizumab injection shows decrease in the caliber of the vessels in the neovascular complex. (D) The corresponding OCT shows decrease in the area of outer retinal hyper-reflectivity with partial restoration of the foveal contour with improvement in visual acuity from 6/36 to 6/9. (E) At 14 weeks, the patient presented again with diminution of vision to 6/36. OCTA *en face* shows increase in the size of the CNV with a thick feeder vessel and increase in the density and branching of new vessels (yellow arrow). (F) The OCT line scan shows increase in the outer retinal hyper-reflectivity compared to the previous scan with retinal thickening and blunting of the foveal contour. Based on these findings, the patient was advised repeat intravitreal ranibizumab injection in this eye.

Conclusions: OCTA technique allows better understanding of CNV lesions in posterior uveitis and evaluation of the morphology of these lesions. Using OCTA, better decision-making with regard to anti-VEGF therapy may be possible leading to earlier recognition, treatment and potentially better visual outcomes. Finally, OCTA allows improved understanding of the pathology of CNV in choroiditis and the study of its natural history. Further studies with larger sample size and longer follow-up visits are warranted.