M. C, 69 years-old

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Centre Hospitalier Intercommunal de Creteil
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## Clinical examination

<table>
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<th>Item</th>
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<td>BCVA</td>
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<tr>
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<tr>
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<td>20/120</td>
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<tr>
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<tr>
<td>Dilated fundus examination</td>
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October
So, what’s your diagnosis?

Chronic central serous chorioretinopathy
October

→ Lucentis RE
November

20/32

20/120
This case is depicting the efficiency of OCTA for the diagnosis of CNV associated with CSC, while there was no evidence of CNV on multimodal imaging.
Optical Coherence Tomographic Angiography of Choroidal Neovascularization Associated With Central Serous Chorioretinopathy

Outer retinal vascular network

Focal areas of reduced choriocapillaris flow

Cross-sectional OCT angiograms demonstrated type 1 CNV
BEVACIZUMAB

3 weeks after

- Increased retinal vessel density
- Reduced CNV flow area
- Smaller choriocapillaris defect
Chronic central serous chorioretinopathy imaged by optical coherence tomographic angiography.

Quaranta-El Maftouhi M, El Maftouhi A, Eandi CM

### OCT B-scans
- 2 profiles of the RPE
  - slight RPE detachment with small undulations (7 eyes)
  - flat RPE profile (5 eyes)

### OCTA
- CNV in all cases with ondulated RPE
- Normal circulation in eyes with a flat RPE profile

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<th>(Years)</th>
<th>(Snellen)</th>
<th>(µm)</th>
<th>Fluid</th>
<th>Profile</th>
<th>OCT Angiography</th>
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Hyperfluorescent superfoveal area
No leakage on late phase angiograms

Early-phase ICG angiography: hyperfluorescent area without a clear branching vascular network

Late-phase ICG angiography:
- area of choroidal hyperpermeability
- focal hypofluorescent spots corresponding to RPE defects

Horizontal B-scan OCT of the hyperfluorescent area: irregular slight PED and opaque content

OCTA at the level of the choroid: distinct neovascular network in the same area as the ICG hyperfluorescence
Mid-phase ICGA
Corresponding area of choroidal hyperpermeability

Fluorescein angiography
Subfoveal neurosensory detachment

Vertical OCT B-scans
Subfoveal neurosensory retinal detachment
Flat and regular RPE
Choroidal thickness increased

OCTA
Absence of CNV
Optical Coherence Tomography Angiography in Central Serous Chorioretinopathy

Eliana Costanzo,1,2 Salomon Yves Cohen,1 Alexandra Miere,1
Giuseppe Querques,1,3 Vittorio Capuano,1 Oudy Semoun,1 Ala’a El Ameen,1
Hassiba Oubraham,1 and Eric H. Souied1

8 CSC complicated by CNV
- 100% of cases, OCTA was able to show an abnormal choroidal vessel pattern at the choriocapillaris
- Abnormal flow in the manual outer retina segmentation

3 cases of false positive
- abnormal choroidal vessel pattern at the choriocapillaris
- no typical features of neovascular membrane on multimodal imaging

Thus, abnormal choroidal vessels at the choriocapillaris should not systematically be considered as CNV
Take home messages

- Excellent sensitivity of OCTA for the diagnosis of CNV in CSC
- Specificity to be evaluated: abnormal dilated choroidal vessels to be distinguished from CNV
- Dark areas: flow void due to a focal atrophy of the choriocapillaris secondary to compression by the enlarged vessels from the outer choroid
- Ondulated PED in OCT B scan: associated with CNV
- Vessel arteriolisation after anti-VEGF treatment, as noticed by Spaide at al.
Thank you for your attention
Conclusion jama

- Optical coherence tomographic angiography provides a novel way to potentially detect CNV. In this case, OCT angiography identified CNV associated with CSC, while findings on structural OCT, FA, and ICGA were nondiagnostic. Because OCT angiography detects CNV by depth (flow in outer retina), it is not dependent on specific dye leakage patterns.
- The OCT angiograms showed reduced CNV flow area and CNV vessel loss following treatment.
- Optical coherence tomographic angiography can also be used to evaluate blood flow of the choriocapillaris. In healthy eyes, the choriocapillaris appears confluent on OCT angiograms. In this case, areas of reduced choriocapillaris flow were noted. Choroidal ischemia has been proposed as a precursor to CNV. Further study is needed to determine whether reduced choriocapillaris flow is associated with chronic CSC and whether it may increase risk of CNV development.
This study showed that CNV complicating chronic CSC is only detectable with OCT angiography. Although choroidal neovascularization is a well-known complication in eyes with chronic CSC, it is considered to be a rare occurrence. In our study, only 2 eyes presented with these characteristic tomographic signs, and the remaining eyes exhibited either small undulations or flat PED profiles with increased or normal sub-RPE reflectivity. Moreover, with the en face OCT imaging modality, no CNV or so-called “hematocrit signs” were evident in our cases. In contrast, when we analyzed the split-spectrum amplitude-decorrelation angiography images, the presence of choroidal neovessels was evident under the RPE. This finding is consistent with the report of Fung and associates based on a case series of CSC patients with type I or subretinal pigment epithelium neovascularization. It is currently a common belief that PCV is a variant of type 1 neovascularization rather than a distinct vascular abnormality of the choroidal vessels, as has been proposed by some authors. Other studies have described the presence of PCV and CSC, which suggests the possibility that the development of polypoidal lesions might be secondary to long-standing exudation or the nonspecific RPE dysfunction typical of chronic CSC.
Clinically, it is occasionally difficult to differentiate these 2 entities. Demographic characteristics and histories are useful in most of the cases, as are angiographic and tomographic examinations. However, in asymptomatic patients, a type 1 CNV- or PCV-like lesion might already be present without any sign of choroidal neovessels, such as lipid exudation, subretinal fluid, RPE detachment, or ICG angiographic hyperfluorescence. Recently, Hage and associates\textsuperscript{15} reported the presence of CNV correlated with flat irregular PEDs in 10 of 53 eyes with chronic CSC. The remaining 43 eyes were classified as presumed avascular flat irregular PEDs based on clinical and angiographic characteristics and the absence of evolution over a long period of time. In contrast, although we observed similar tomographic findings (such as opaque and hyperreflective contents of the PEDs) in the present study, we were able to demonstrate the presence of CNV in all cases with irregular RPE profiles only with OCT angiography. Specifically, the qualitative analysis of the split-spectrum amplitude-decorrelation angiography images and B-scans of our case series revealed that the locations of the CNVs corresponded to the areas of slightly irregular and hyperreflective RPE, while no CNV was detected on the split-spectrum amplitude-decorrelation angiography images when the RPE profile was flat and linear. Therefore, a CNV should always be suspected when a small and undulating PED is present on a B-scan.

These findings confirm the pathogenetic mechanism that has been proposed by some authors,\textsuperscript{13} and\textsuperscript{14} Ahuja and associates described polypoidal lesions as secondary manifestations of chronic exudation and RPE alterations typical of chronic CSC.\textsuperscript{13} Moreover, Chung and associates examined patients with PCV and chronic CSC and suggested that PCV is more likely a secondary manifestation than a primary pathology of the choroid.\textsuperscript{14} Therefore, it might be postulated that CSC and PCV share a common and convergent pathogenesis.

The early detection of CNV is crucial for a good visual outcome. The earlier the CNV is diagnosed and treated, the better is the final visual acuity that can be achieved. The relationship is also valid for CNV complicating chronic CSC. Therefore, the possibility of detecting choroidal neovascularization via OCT angiography in the absence of any other sign of CNV presented in this report is particularly relevant to chronic CSC patients. Split-spectrum amplitude-decorrelation angiography analysis is helpful in the visualization of CNV and allows for prompt and correct treatment of this complication that will, we hope, result in better visual outcomes.

OCT angiography presents several limitations. In particular, it requires that the patient fixate precisely for several seconds, and images are restricted to a small area. However, despite these limitations, OCT angiography is a useful noninvasive method to image details of the retinal and choroidal vasculature without injection of dye. Moreover, it is an evolving technique and the interpretation of the images needs to be refined further.

In conclusion, this study reports OCT angiography findings in patients with chronic CSC. With this imaging technique, we were able to demonstrate the presence of choroidal neovessels that were not visible with other imaging techniques. Despite the relatively small number of eyes included in this study, the findings from OCT angiography were consistent and repeatable. Further investigations in larger groups of subjects with chronic CSC are needed to assess the definitive role of this new imaging modality.