Disorganization of retinal inner layers is associated with reduced contrast sensitivity in retinal vein occlusion

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Disclosures

• No relevant disclosures
Summary

In a prospective observational cohort study of 58 visits from 31 patients with retinal vein occlusion with a history of macular edema, disorganization of the retinal inner layers (DRIL) was found to be significantly associated with worse contrast sensitivity as assessed by a novel quick contrast sensitivity function (qCSF) method.
Disorganization of retinal inner layers (DRIL)

- Lack of distinguishable boundaries between the ganglion cell-inner plexiform layer complex, inner nuclear layer, and outer plexiform layer
- Prognostic marker for worse visual acuity in diabetic macular edema (DME) and retinal vein occlusion (RVO)

Inner retinal layers

- **Ganglion cells**
  - M cells more sensitive to low-contrast stimuli

- **Bipolar cells**
  - Center-surround receptive field activated by contrast

- **Horizontal cells**
  - Lateral inhibition enhances contrast at light-dark borders

DRIL and contrast sensitivity

- Contrast sensitivity important for patients’ visual functioning
- DRIL associated with reduced contrast sensitivity in DME (only one previous study)
- No previous studies assessing contrast sensitivity in retinal vein occlusion with macular edema

Purpose

To determine if DRIL is associated with reduced contrast sensitivity in patients with RVO with a history of macular edema
Study design

• Prospective, observational, cohort study at single institution
• Included patients with a diagnosis of RVO with a history of macular edema
• Excluded eyes with diabetic retinopathy, other vitreoretinal disease, or ocular surgery within 6 months
• Best-corrected visual acuity and lens status recorded
• Spectral-domain OCT at every visit
• Contrast sensitivity testing with novel quick contrast sensitivity function (qCSF) method
Relative to the 14+15=29 size-contrast combinations used by ETDRS and Pelli-Robson testing....
tests patients with an intelligent sampling algorithm...
Image grading

• Seven OCT B-scans analyzed for each scan (foveal and 3 adjacent scans above and below spaced 120 μm apart)

• Central 1 mm of each scan assessed for presence and extent of DRIL

• Scans also assessed for intraretinal fluid (IRF), subretinal fluid (SRF), epiretinal membrane (ERM), hyper-reflective foci, ellipsoid zone (EZ) disruption, and external limiting membrane (ELM) disruption

• Central macular thickness (CMT) and central foveal thickness (CFT) recorded
Statistical analysis

• Mixed-effect univariable and multivariable linear regressions performed for logMAR best-corrected visual acuity (BCVA) and the area under the log contrast sensitivity function (AULCSF)

• Backwards elimination procedure used for multivariable regressions
Results

• 58 visits of 31 patients
• 50% for BRVO, 50% for CRVO
• Average age 63.9 ± 10.5 years (range 35 – 80)
• Average # of visits 1.9 ± 1.2 (range 1 – 6)
• No phakic patients had nuclear sclerosis recorded as worse than 2+
• All patients except two receiving anti-VEGF therapy
• 69% of scans showed presence of DRIL
# Imaging characteristics

<table>
<thead>
<tr>
<th></th>
<th>No DRIL</th>
<th>DRIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>logMAR VA</td>
<td>0.093 ± 0.091 (~20/25)</td>
<td>0.28 ± 0.18 (~20/40)</td>
</tr>
<tr>
<td>AULCSF</td>
<td>1.0 ± 0.28</td>
<td>0.73 ± 0.30</td>
</tr>
<tr>
<td>DRIL extent (μm)</td>
<td>0</td>
<td>381 ± 271</td>
</tr>
<tr>
<td>CMT (μm)</td>
<td>294 ± 42</td>
<td>389 ± 150</td>
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<tr>
<td>CFT (μm)</td>
<td>219 ± 47</td>
<td>322 ± 182</td>
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</tbody>
</table>
Contrast sensitivity function

- OD – normal
- OS – RVO with macular edema and DRIL on OCT

- Spatial frequencies of 3 and 6 cycles per degree (cpd) more significantly affected in DRIL
Independent predictors of worse BCVA

- Larger DRIL extent ($p = 0.004$)
- Increased central foveal thickness ($p = 0.002$)
- 2+ nuclear sclerosis ($p = 0.001$)
Independent predictors of worse AULCSF

- Larger DRIL extent ($p = <0.001$)
- Increased central macular thickness ($p = 0.007$)
- Decreased central foveal thickness ($p = 0.024$)
- 2+ nuclear sclerosis ($p = 0.001$)
Conclusions

• DRIL is independently associated with worse visual acuity and contrast sensitivity in eyes with RVO with history of macular edema
• DRIL is an important structural imaging biomarker correlating with visual function
• The quick contrast sensitivity function has potential as endpoint in clinical trials
• Future directions – OCTA correlation, impact of anti-VEGF therapy
Thank you!

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