Hemoglobin measurement in the optic nerve head using the Laguna ONHe program: Comparison with Spectralis OCT and image quality dependency

Martina Gonzalez-Hernandez (martingonzeh@gmail.com)
Hospital UniversitariCanarias
Silvia Alayon Miranda
University of La Laguna
Jose Sigut Saavedra
University of La Laguna
Manuel Gonzalez de la Rosa
University of La Laguna, Spain

PURPOSE
To evaluate the influence of image quality on glaucoma diagnosis by measuring hemoglobin content in the optic nerve by means the Laguna ONHe program (INSGFT, Spain) and compare its results with those of Spectralis OCT (Heidelberg, Germany).

The Laguna ONHe program divides conventional color images of the optic nerve head into 24 sectors using two ellipses, approximately parallel to its edge, and four diametrical lines. It notes the differences between its red and green components and compensates the diversities of spectral composition of the illumination light, the absorption of the lens and the spectral response of the detector used by means a relative measure: the values of the tissue are divided by those obtained in the central vessels. (See references below)

Previous experience in 700 normal and 494 glaucoma images obtained with Nidek, Kowa and Topcon fundus cameras was used to optimize the Laguna ONHe index “Glaucome Discriminant Function, GDF”.

METHODS

56 healthy subjects and 82 confirmed and suspect glaucoma were examined twice with the Laguna ONHe method (INSGFT, Spain), using images obtained with the Horus DEC-200 portable fundus camera (NRC, Taiwan), and once with the Spectralis OCT (Heidelberg, Germany). The images were divided into two groups of better and worst contrast, comparing vessels vs tissue, using the red and green channels in the optic nerve image. Differences between outcomes were analyzed with the MedCalc 17.9.7 program.

RESULTS

Both series respectively had contrasts of 1.580.33 and 1.950.03 (p<0.001). The Pearson correlation coefficient between GDF and BMO-MRW was 0.827-0.851 in the two groups of images (p>0.001, Fig. 1), between GDF and RNFL was 0.763-0.766 (p<0.001) and between BMO-MRW and RNFL was 0.848 (p<0.001, Fig 2).

Intra-class correlation coefficient between the GDF values of the two exams was 0.997. Using ROC analysis, we calculated the confidence intervals (5%-95%) of the area under the curve, the specificity closed to 95%, and the corresponding sensitivity.

The following results were obtained:

<table>
<thead>
<tr>
<th>Method</th>
<th>Area Under Curve</th>
<th>95% CI</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laguna RNHe, best images</td>
<td>0.860-0.945</td>
<td>94.8%</td>
<td>70.7%</td>
<td></td>
</tr>
<tr>
<td>Laguna RNHe, worst images</td>
<td>0.876-0.930</td>
<td>94.9%</td>
<td>70.9%</td>
<td></td>
</tr>
<tr>
<td>Spectralis BMO-MRW</td>
<td>0.910-0.961</td>
<td>94.9%</td>
<td>70.3%</td>
<td></td>
</tr>
<tr>
<td>Spectralis RNFL</td>
<td>0.891-0.943</td>
<td>94.8%</td>
<td>74.4%</td>
<td></td>
</tr>
</tbody>
</table>

Comparatively analyzing these results, the sensitivity of the best OCT Spectralis index did not reach statistically significant differences with the sensitivity of images analyzed with the GDF of Laguna RNHe (p=0.19-0.26).

CONCLUSION

Using a simple manual fundus camera to study the distribution of hemoglobin in the optic nerve achieves a diagnostic capacity of glaucoma almost equivalent, or minimally different, to an OCT, even using images of sub-optimal quality.

REFERENCES