OXYMETRY IN GLAUCOMA: CORRELATION OF METABOLIC CHANGE WITH STRUCTURAL AND FUNCTIONAL DAMAGE

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ABSTRACT

Severe glaucomatous damage is associated with increased oxygen saturation in retinal vessels and decreased arteriovenous difference in retinal oxygen saturation. These data suggest that in eyes with severe glaucomatous damage, retinal oxygen consumption is decreased due to tissue loss.

METHODS

59 open angle glaucoma patients were included

Examination performed on the same day:

Non-invasive retinal oximetry

Durophy Field Analysis:
(Ultraschall, Germany)

Automated perimetry

Gonioscop:
(Inter视, Trempe Leblond, Switzerland)

Heidelberg Retinal Tomography

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97 ± 2
97 ± 2
98 ± 2
0.3
65 ± 6
65 ± 6
69 ± 3
0.0003
33 ± 6
33 ± 6
29 ± 3
0.002

RESULTS

CONCLUSIONS

Preliminary results with the dual wavelength oximeter pointed out that deeper glaucomatous visual field defects are associated with decreased arteriovenous (AV) differences in retinal oxygen saturation. These data suggest that a change in oxygen metabolism occurs in glaucomatous retina and this reduced oxygen metabolism may be related to tissue atrophy (Olafsdottir et al., IOVS, 2011).

BACKGROUND

To determine whether retinal vessel oxygen saturation in glaucoma patients is associated with structural optic disc and retinal nerve fiber layer (RNFL) changes and visual field defects.

PURPOSE

To determine whether retinal vessel oxygen saturation in glaucoma patients is associated with structural optic disc and retinal nerve fiber layer (RNFL) changes and visual field defects.

METHODS

Structural damage

Retinal oxygen saturation in glaucoma patients was measured with a non-invasive spectrophotometric retinal oximeter (Durophy etl, Reykjavik, Iceland). Visual fields and RNFLs were performed on the same day. Statistical analysis was performed using Student's t-test and Pearson correlation coefficient when the data were normally distributed; otherwise Spearman correlation was used.

RESULTS

Mean oxygen saturation in the arteries was 97 ± 2%, in venules 65 ± 6% and the arteriovenous difference was 32%. A 0.07 ± 0.42% oxygen saturation in the venules correlated with the visual field mean defects (p = 0.42; p = 0.06; n = 9); as well as with the structural RNFL parameters rim area and RNFL (r = 0.36; p = 0.006 and r = 0.26; p = 0.05 respectively; n = 51). Arteriovenous difference in oxygen saturation decreased significantly as the visual field defect worsened (r = 0.28; p = 0.005), as the rim area diminished (r = 0.29; p = 0.03) and as the RNFL decreased (r = 0.27; p = 0.05). No correlation was found between this oxygen saturation in the retinal arteries and visual field mean defect (r = 0.813; p = 0.04) rim area (p = 0.12; p = 0.62) and RNFL (r = 0.044, 0.59).

CONCLUSIONS

Severe glaucomatous damage is associated with increased oxygen saturation in retinal vessels and decreased arteriovenous difference in retinal oxygen saturation. These data suggest that in eyes with severe glaucomatous damage, retinal oxygen consumption is decreased due to tissue loss.

Sterometric Analysis ONH Normal

Disc Area 2.33 1.63 - 2.43
Cup Area 0.87 0.11 - 0.68
Rim Area 1.46 1.31 - 1.96
Cup Volume 1.46 1.31 - 1.96
Rim Volume 1.14 1.05 - 1.24
Cup/Disc Area Ratio 0.37 0.31 - 0.49
Mean RNFL Thickness 0.19 0.20 - 0.32
RNFL Cross Sectional Area 1.05 0.99 - 1.66

Glaucoma patients MD < -6 dB MD > -12 dB p-value
(n= 59) (n= 29) (n= 14)  between MDs
Sat O2 Sat O2 Sat O2 Sat O2
(%) (%) (%) (%)