Intraocular pressure magnitude and variability as predictors of rates of structural change in non-human primate experimental glaucoma

Gardiner SK, Fortune B, Wang L, Downs JC, Burgoyne CF.

The purpose of this study is to determine the effects of intraocular pressure (IOP) mean, maximum and variability on the rate of structural change in experimental glaucoma. Data were taken retrospectively from 59 non-human primates involved in ongoing studies of experimental glaucoma. IOP was measured by tonometry every 1-3 weeks, and these readings split into non-overlapping fixed-length windows.

First, different characterizations of IOP variability were tested to find the one that was least correlated with the mean IOP within the same window. Next, the rates of change of the Mean Position of the Disc (MPD) from confocal scanning laser tomography, and Retinal Nerve Fiber Layer Thickness (RNFLT) from spectral domain ocular coherence tomography, were calculated over each window.

Mixed effects models were formed to predict these rates based on the characterizations of IOP. Normalized root mean squared residual (RMSR) from the trend of IOP during windows of five IOP measurements provided a characterization of variability showing lowest correlation with mean IOP (r < 0.001). In univariate analyses, rate of change of MPD and RNFLT were predicted by mean IOP (p < 0.001 for both) and maximum IOP (p < 0.001 for both). IOP variability did not significantly predict change in MPD (p = 0.129) or RNFLT (p = 0.438). In bivariate models, maximum IOP was the most significant predictor of change.

We conclude that normalized RMSR allows the effects of IOP variability to be assessed independently of mean IOP. Maximum IOP provided the best predictability of structural change, either causally or because it captures the contributions of both mean and variability.

Copyright © 2012 Elsevier Ltd. All rights reserved.


PMID: 22960316