Glaucoma Drug Response Variations: Description of a Multi-Center Study of Aqueous Humor Dynamic Phenotypes in Glaucoma

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Posterboard#: A0436

Abstract Number: 5136 - A0436

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DisclosureBlock: Nadine M. Helmy, None; David M. Reed, None; Carol B. Toris, None; Arthur J. Sit, None; Arash Kazemi, None; Vikas Gulati, None; Shan Fan, None; Sayoko E. Moroi, Code F (Financial Support) NIH

Purpose
We describe preliminary results of a study to test the hypothesis that individual aqueous humor dynamic (AHD) variables can predict glaucoma medication response.

Methods
In 4 visits, we measured intraocular pressure (IOP), aqueous humor flow rate (Fa), episcleral venous pressure (EVP), and tonographic outflow facility (Cton) before and after treatment with timolol and latanoprost. We examined relationships among age, gender, central corneal thickness (CCT), corneal hysteresis (CH), IOP, EVP, Cton, and Fa.

Results
Forty glaucoma participants (67 eyes, 60 ± 6 years old) were enrolled. OD and OS were highly correlated with each other ($\rho > 0.85$) except for EVP and Fa. LMMs indicate that age and sex were not significant when considering IOP, CH, CCT, EVP, and Fa in models accounting for paired eye correlation. When treated with latanoprost IOP decreased an average of 3.5 mmHg [95%CI 2.6, 4.4] with 3/67 eyes increasing in IOP. CH increased under both treatments: timolol by 0.63 [95%CI 0.33, 0.91] and latanoprost by 0.72 [95%CI 0.47, 0.97]. Fa decreased with timolol by 1.04 µL/min [95%CI -1.3, -0.83, $p < 0.001$] regardless of baseline value. With latanoprost the mean decrease was 0.14 µL/min [95%CI -0.34,

0.07, p = 0.183]. In those with baseline Fa < 3 µl/min Fa with latanoprost treatment tended to increase, with the opposite true in those > 3 µl/min. Under timolol about 50% of subjects had a Cton increase, while under latanoprost 80% increased. Cton in those with baseline Cton > 0.2 µl/min/mmHg tended to decrease with timolol treatment, with the opposite true in those < 0.2 µl/min/mmHg.

Conclusions

In individuals with glaucoma, there was a significant response in Fa to timolol, but not latanoprost. A small subset of eyes with Cton values indicates that there may be a treatment effect on outflow. Baseline Fa and Cton values may be predictive of latanoprost & timolol response, respectively. These preliminary results are the basis of our study to explore AHD phenotypes and variations in response to glaucoma medications.