A NEW APPROACH OF DIURNAL VARIATION ANALYSIS OF INTRAOCULAR PRESSURE IN NORMAL-TENSION GLAUCOMA USING CIRCULAR NON LINEAR MIXED EFFECT MODEL

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The glaucoma is the third biggest cause of vision loss in Japan. The therapy on the normal-tension glaucoma (NTG) among various type of glaucoma is particularly important because almost 60% of glaucoma patients are suffered from NTG. Concerning the NTG therapy, we should pay attention to the diurnal variation of intra-ocular pressure (IOP).

In previously conducted statistical analyses, a cosine curve was applied to data as a model to evaluate the time dependency of IOP or linear models for treatment differences were applied at various time periods of measurement, both methodologies being inadequate to recognize the whole aspect of time dependency.

In this study, a circular non linear mixed effect model was newly applied to the analysis of diurnal variation of IOP and the performance of the proposed model was examined through a Monte Carlo simulation, focusing on the biases in estimation.

It demonstrated that the previous methods induced serious bias when the treatment drug had an effect on the individual circadian rhythm. The amplitude parameters were likely to yield greater estimates when a two-stage method was used and smaller estimates when a first order approximation was used in integration.

The assumed model was highly effective for understanding the circadian rhythm of IOP and the Gaussian quadrature method for integration yielded unbiased estimates.