Editorial

Challenging the Dogma – It Takes 5 Years for Visual Field Defects to Appear After Glaucoma Damage

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Recently, I had an opportunity to observe a postgraduate evaluation. One of the questions was; how long does it take for a visual field defect to appear in glaucoma? The favoured answer was 5 years. This led me to ponder on the authenticity of this commonly taught concept.

Conceptually, all glaucoma patients progress, albeit at different rates and their rate of change is the most objective measure to guide treatment decisions and interventions. A rate of progression resulting in significant decrease in vision related quality in a patient's lifetime requires expert input and many a times an aggressive management.

Optic neuropathy in glaucoma is characterized by progressive neuro-retinal rim thinning, excavation and loss of retinal nerve fibre layer. The structural change is followed by functional loss. Although there is an undeniable relationship between structural and functional damage in glaucoma, the exact structure-function association is less well understood and the precise evolution over time is still unclear.[1,2]

Majority of published evidence on structure-function relationship is based on cross-sectional data but it is extrapolated to infer what would be the true longitudinal course of changes in a patient.[3]

These studies used quantitative structural measures i.e., RNFL thickness derived from OCT and used psychophysical tests such as standard automated perimetry for functional correlation. Thus there is an uncertainty as to which mathematical model may be the best suited in such a situation.[4]

It should be noted that visual field indices are expressed in logarithmic scale (dB) but the measurements of structural parameters are in longitudinal readings like microns. To make sense, logarithmic data is then scaled into linear data. This scaling may introduce artifactual relationship between structural and functional measurements of glaucoma.[5]

The logarithmic scale means that even slight changes at low decibel values are pronounced but changes at high decibel levels will be minimized. Therefore visual function changes would be less apparent in early stages of structural damage giving an impression that structural damage happens first. This can be made clear with the following example. Considering a linear rate of retinal ganglion cell loss in glaucoma, a 10% loss of RGCs from 100% to 90% (early damage) would correspond to approximately 0.5db loss. Thus, in a field region with age expected sensitivity of 30db, such a change would represent only 1.66% (0.5/30 × 100) loss in sensitivity. However , in the more advanced stage, 10% loss from 50% to 40% in the amount of surviving RGC's will represent 1 dB loss in logarithmic scale and 3.3% (1/30 × 100) sensitivity in percentage scale. Thus, the same rate of structural loss will translate into greater rate of visual function loss in later stages of the disease as compared to the earlier stages.[6]

At this point it is mandatory to understand that despite little or no identifiable change on visual field

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testing in early glaucoma, the vision related quality of life (QoL) may still be adversely affected especially related to the distance activities, driving and colour vision.[7]

Studies have attempted to quantify the lack of agreement in structure and function measurements and have proposed methodologies to predict functional damage from structural losses measured by OCT i.e. Hood report which is now commercially available in Topcon OCT and Hiedelberg retinal Tomograph machines.[8]

Sliding into the comfort of an incorrect belief that no changes in visual fields for at least 5 years may lead to complacency in the management and potential patient harm.

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