



ORIGINAL ARTICLE

Retinal nerve fiber layer thickness in glaucomatous Nepalese eyes and its relation with visual field sensitivity



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Abstract

Background: To evaluate peripapillary retinal nerve fiber layer (RNFL) thickness in glaucomatous Nepalese eyes using spectral domain optical coherence tomography (SD-OCT) and study its relationship with visual field sensitivity.

Methods: A total of 120 eyes comprising primary open angle glaucoma (POAG), glaucoma suspects (GS), normal tension glaucoma (NTG) and healthy subjects ($n = 30$ cases in each group) underwent a complete ophthalmic examination, including optic nerve head (ONH) evaluation and standard automated perimetry (SAP). RNFL thickness measurements around the optic disk were taken with circular spectral domain optical coherence tomography (SD-OCT) scans. Analysis of variance (ANOVA) was used for comparison of RNFL parameters among various study groups. The relationship of RNFL parameters with visual field (VF) global indices was evaluated with regression analysis.

Results: The mean pRNFL thickness was significantly less in the POAG ($64.30 \pm 14.45 \mu\text{m}$, $p < 0.01$), NTG ($85.43 \pm 9.79 \mu\text{m}$, $p < 0.001$) and GS ($102.0 \pm 9.37 \mu\text{m}$, $p < 0.001$) groups than in the healthy group ($109.8 \pm 8.32 \mu\text{m}$). The RNFL was significantly thinner across all quadrants in all study group pairs ($p < 0.05$) except for normal vs. GS (only superior and inferior quadrant, significant). Linear regression plots with RNFL thickness as a predictor of MD and LV demonstrated a strong and statistically significant degree of determination in the POAG group ($R^2 = 0.203$ and 0.175 , $p = 0.013$ and 0.021).

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PALABRAS CLAVE

Glaucoma;
Capa de fibras
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Tomografía de
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Campo visual;
Glaucoma primario
de ángulo abierto

Conclusion: The RNFL thickness measurements with SD-OCT are lower in glaucomatous eyes as compared to age-matched GS and normal eyes in the Nepalese population. A high resolution SD-OCT could aid significantly in the early diagnosis of glaucoma in Nepal.

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Grosor de las capas de fibras nerviosas retinianas en pacientes nepalís con glaucoma, y su relación con la sensibilidad del campo visual

Resumen

Antecedentes: Evaluar el grosor de la capa peripapilar de fibras del nervio óptico retiniano (RNFL) en ojos de pacientes con glaucoma de Nepal, utilizando la tomografía de coherencia óptica de dominio espectral (TCO-DE), y estudiar su relación con la sensibilidad del campo visual.

Métodos: Se sometió a un examen oftalmológico completo a un total de 120 ojos que incluían: glaucoma de ángulo abierto (POAG), sospecha de glaucoma (GS), glaucoma de tensión normal (NTG) y sujetos sanos (n=30 casos en cada grupo), incluyendo evaluación de la cabeza del nervio óptico (ONH) y perimetría automatizada estándar (SAP). Se realizaron las mediciones del grosor de RNFL alrededor del disco óptico mediante tomografía de coherencia óptica de dominio espectral circular (TCO-DE). Se utilizó el análisis de varianza (ANOVA) para comparar los parámetros de RNFL entre los diversos grupos de estudio. Se evaluó la relación de los parámetros de RNFL con los índices globales del campo visual (CV), mediante un análisis de regresión.

Resultados: El grosor medio de pRNFL fue considerablemente menor en el grupo de POAG ($64,30 \pm 14,45 \mu\text{m}$, $p < 0,01$), NTG ($85,43 \pm 9,79 \mu\text{m}$, $p < 0,001$) y GS ($102,0 \pm 9,37 \mu\text{m}$, $p < 0,001$), que en el grupo sano ($109,8 \pm 8,32 \mu\text{m}$). El RNFL fue significativamente menor en todos los cuadrantes de todos los pares de grupos de estudio ($p < 0,05$) excepto para el grupo normal frente al GS (únicamente fueron significativos los cuadrantes superior e inferior). Las gráficas de regresión lineal, utilizando RNFL como factor predictivo de MD y LV demostraron un grado sólido y estadísticamente significativo de determinación en el grupo de POAG ($R^2 = 0,203$ y $0,175$, $p = 0,013$ y $0,021$).

Conclusión: Los valores del grosor de RNFL medidos mediante TCO-DE son inferiores en ojos con glaucoma, en comparación a ojos con GS de sujetos con rangos de edades equivalentes así como a los ojos normales en la población nepalí. Una TCO-DE de alta resolución podría ayudar considerablemente al diagnóstico precoz del glaucoma en Nepal.

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Glaucoma is characterized by slow progressive degeneration of retinal ganglion cells (RGCs) and their axons, resulting in a distinct appearance of the optic disk and a concomitant pattern of visual loss.¹ Glaucomatous disease is usually diagnosed and managed with measurements of structural and functional alterations associated with losses of RGCs and their axons.² According to the World Health Organization (WHO), glaucoma is the leading cause of blindness in the world, second only to cataracts, and is considered the principal cause of irreversible blindness worldwide.³ A recent report estimated that there are 60.5 million people worldwide with glaucoma which will increase to 80 million by 2020,⁴ and glaucoma is responsible for 8% of all causes of global blindness.⁵ Glaucoma is also a major cause of blindness in Nepal. According to National Blindness Survey, it is the fourth major cause of bilateral blindness with a prevalence of 3.2% among various causes.⁶ Recent glaucoma surveys done in different ethnic groups in Nepal revealed the prevalence of glaucoma ranging from 1.38% to 12.4%.^{7,8}

Furthermore, a study reported that the knowledge of glaucoma is very low in a hospital presenting population in Eastern Nepal.⁹

Standard Automated Perimetry (SAP) has remained the gold standard in glaucoma diagnosis and management, and without it, modern glaucoma management is not possible.¹⁰ However, the last decade has seen the emergence of a variety of new technologies for the objective, non-invasive, measurement of structural changes secondary to RGC damage. Newer versions of OCT that incorporate spectral domain (SD) technology provide higher scan resolution and higher speed than conventional time domain (TD) OCT.^{11,12} The Spectralis HRA + OCT (Heidelberg Engineering) is the combination of a confocal scanning laser ophthalmoscopy (CSLO) and a SD-OCT that enables the operator to capture a wide variety of retinal images with high resolution and superior quality.

RNFL loss precedes measurable ONH and VF damage and is observed in 60% of eyes approximately six years

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