ORIGINAL RESEARCH

Peripapillary Retinal Nerve Fiber Layer Thickness as a Predictor of Visual Outcomes in Patients with Acute Nonarteritic Anterior Ischemic Optic Neuropathy

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Objective: To evaluate the utility of peripapillary retinal nerve fiber layer thickness (pRNFLT) for the prediction of visual outcomes, including visual acuity (VA) and visual field (VF), in subjects with acute nonarteritic anterior ischemic optic neuropathy (NAION).
Materials and Methods: We performed a retrospective study of data relating to 60 eyes of 60 subjects with acute NAION. Of these, reliable VF values were obtained at both the initial and at 6-month follow-up visits for 30 eyes, which were included in the VF analysis. The pRNFLT was measured globally and separately in all four quadrants (superior, inferior, nasal, and temporal) using optical coherence tomography at the initial visit. Multivariate analysis and the area under the curve (AUC) were used to evaluate the utility of pRNFLT for the prediction of visual outcomes, including favorable VA (VA better than or equal to 20/25) and favorable VF (visual field index (VFI) ≥90%), at the 6-month follow-up visit.
Results: The median VA and mean VFI at the initial visit were 0.40 (interquartile range (IQR): 0.40, 0.54; logarithm of the minimum angle of resolution (logMAR)) and 73.07% ± 6.73%, respectively. The median VA and mean VFI at the 6-month follow-up visit were 0.30 (IQR: 0.00, 0.70) logMAR and 69.27% ± 28.94%, respectively. Thinner temporal-quadrant pRNFLT was associated with favorable VA (odds ratio 0.98; $p = 0.042$) with a cut-off value of 128 μm (AUC 0.839, 95% CI: 0.732–0.947, sensitivity 77.27%, specificity 84.21%). Thinner nasal-quadrant pRNFLT was associated with favorable VF (odds ratio 0.97; $p = 0.047$) with a cut-off value of 105 μm (AUC 0.780, 95% CI: 0.612–0.948, sensitivity 90.00%, specificity 70.00%).
Conclusions: The pRNFLT is clinically useful for the prediction of visual outcomes in patients with acute NAION. A temporal-quadrant pRNFLT ≤128 μm and a nasal-quadrant pRNFLT ≤105 μm predict favorable VA and VF at the 6-month follow-up visit, respectively.
Keywords: nonarteritic anterior ischemic optic neuropathy, peripapillary retinal nerve fiber layer thickness, optical coherence tomography, visual acuity, visual field, visual prognosis

Introduction

Nonarteritic anterior ischemic optic neuropathy (NAION) is the most common cause of acute optic neuropathy in patients who are older than 50 years.[1,2] By definition, anterior ischemic optic neuropathy affects the intraocular segment of the optic nerve, also known as the optic disc, and results in visible optic disc swelling and peripapillary retinal nerve fiber layer (pRNFL) swelling, during the acute phase.

The pathophysiology of acute NAION involves compromise to the retrolaminar portion of the optic disc microcirculation.[3–7] Risk factors include ocular factors, such as structural crowding of the optic disc and ocular hypertension, and systemic factors, such as diabetes mellitus (DM), systemic hypertension (HT), dyslipidemia (DLP), obstructive sleep apnea (OSA), and smoking.[6–13]

A diagnosis of acute NAION is made in the presence of a typical history of acute, painless visual loss, hyperemic optic disc swelling with peripapillary hemorrhages, and a small cup-to-disc (C/D) ratio of the fellow eye. Visual acuity (VA) and color vision may be normal if there is no loss of fixation. The most common pattern of visual field (VF) loss is an altitudinal defect, but any pattern may be present.[14]

Currently, no proven effective treatment for acute NAION is available.[15] Therefore, the determination of prognosis is an important part of the therapeutic approaches of this condition. To the best of our knowledge, parameters with potential prognostic value for VA in patients with acute NAION in the Thai population have been evaluated in only one previous study.[16] However, these did not include pRNFL thickness (pRNFLT), and potential predictors of VF were not evaluated. Therefore, in the present study, we aimed to evaluate the utility of pRNFLT for the prediction of visual outcomes, including VA and VF, in subjects with acute NAION.

Materials and Methods

This study was performed in accordance with the principles of the Declaration of Helsinki and was approved by the Institutional Review Board (IRB) of the Faculty of Medicine Ramathibodi Hospital, Mahidol University, Bangkok, Thailand (IRB number: COA. MURA2023/496), which waived the requirement for written informed consent from the subjects owing to the retrospective nature of the study. All the data collected were regarded as confidential and stored in our database. Electronic medical records were reviewed to identify all the subjects diagnosed with NAION from February 2011 to October 2022.

Subjects and Eyes Selection

We included subjects with NAION who met all of the following criteria: 1) they underwent an initial examination within 14 days of the onset of the condition; 2) both VA and VF were assessed, as well as pRNFLT, measured using optical coherence tomography (OCT) at the initial visit; and 3) they underwent assessment of both VA and VF at the 6-month follow-up visit. In subjects with bilateral sequential NAION, only the eye affected first was included in the study, and in those in whom both eyes developed NAION simultaneously, only the more severely affected eye was included. Furthermore, data regarding subsequent episodes of NAION in the same eye were not taken into consideration.

We excluded subjects with one or more of the following: 1) age at onset younger than 18 years and 2) treatment of NAION with systemic corticosteroids. Furthermore, eyes with one or more of the following were excluded: 1) presence of visually significant cataracts and/or diseases other than NAION that could affect VA and/or VF; 2) spherical refractive error outside the range of >5 diopter or greater than 2 diopter of astigmatism; 3) any intraocular surgery during the 6-month follow-up period; and 4) a second episode of NAION occurred in the same eye during the 6-month follow-up period.

Data Collection

Demographic data (sex, age at onset, underlying diseases (DM, HT, DLP, and OSA), and smoking), visual function parameters, including VA and VF, assessed at the initial visit, other ocular parameters assessed at the initial visit (intraocular pressure (IOP) and contralateral C/D ratio), pRNFLT measurements, the treatments, and the visual outcomes, including VA and VF, assessed at the 6-month follow-up visit, were reviewed.

VA was assessed using the Early Treatment Diabetic Retinopathy Study (ETDRS) chart. At the 6-month follow-up visit, the eyes were placed into two groups according to their VA: "favorable VA", defined as VA better than or equal to 20/25, and "unfavorable VA", defined as VA worse than 20/25.

VF was assessed using 24–2 SITA software (Humphrey Field Analyzer, Carl-Zeiss Meditec). A reliable VF assessment was defined as a VF examination that met all of the following conditions: fixation loss <20%, false positive error <33%, and false negative error <33%. We only recorded the VF findings for eyes for which reliable VF assessments had been made at both the initial and at 6-month follow-up visits. As a result, the VF findings for 30 eyes were included in the VF analysis. The visual field index (VFI) was used as a proxy for the severity of a VF defect (as the VF defect increased, the VFI percentage decreased). At the 6-month follow-up visit, the eyes were placed into two groups according to their VF: "favorable VF", defined as VFI ≥90%, and "unfavorable VF", defined as VFI <90%.

pRNFLT was measured using a Cirrus HD-OCT Model 4000 (Carl-Zeiss Meditec) at the initial visit. The optic nerve head cube 200×200 scan protocol was used. OCT images of low signal strength (<7) or with segmentation errors were excluded. The pRNFLT was measured both globally and separately in all four quadrants, therefore the pRNFLT parameters included global and each of the four quadrants (superior, inferior, nasal, and temporal) pRNFLT.

Regarding treatment, the use of aspirin was not analyzed, owing to a lack of evidence of its effectiveness for the treatment of NAION.[17]

Statistical Analysis

Normally distributed continuous data are expressed as mean ± standard deviation (SD) and non-normally distributed continuous data are expressed as median and interquartile range (IQR). The independent *t*-test or the Mann–Whitney *U*-test, as appropriate, was used to compare continuous datasets. Categorical datasets are expressed as frequency and percentage and were compared using the chi-square or Fisher's exact test, as appropriate. For multivariate analysis, logistic regression was used, to simultaneously regress outcomes with datasets whose *p*-values in the univariate analysis were <0.1. Statistical analyses were performed using STATA software, version 18.0 (StataCorp LLC, College Station, TX, USA). Differences were reported with 95% confidence intervals (CIs). $P < 0.05$ was considered statistically significant. The optimal cut-off values were identified using the maximum Youden's index value.[18]

ETDRS VA values were converted to logarithm of the minimum angle of resolution (logMAR) values for statistical analysis. The VA categories of counting fingers, hand motion, light perception, and no light perception were converted to 2.6, 2.7, 2.8, and 2.9 logMAR, respectively.[19,20]

Results

Demographic Data, Visual Function Parameters and Other Ocular Parameters at the Initial Visit, pRNFLT Parameters, Treatments, and Visual Outcomes at the 6-Month Follow-Up Visit

We included data for 60 eyes of 60 subjects with acute NAION, and there were 30 eyes for which reliable VFI values were obtained at both the initial and at 6-month follow-up visits. Therefore, these 30 eyes were included in the VFI analysis. Of the 60 subjects, 29 (48.33%) were male, and the mean age at onset was 58.83 ± 9.52 years. HT was the most common underlying disease (42 subjects, 70.00%), followed by DLP (39 subjects, 65.00%), DM (29 subjects, 48.33%), and OSA (11 subjects, 18.33%). Eight of the subjects (13.33%) had a history of smoking.

At the initial visit, the median VA and mean VFI were 0.40 (0.40, 0.54) logMAR and 73.07% ± 6.73%, respectively. The mean IOP and median contralateral C/D ratio at the initial visit were 14.00 ± 2.97 mmHg and 0.15 (0.10, 0.20), respectively. Neither low signal strength (<7) nor segmentation errors characterized any of the OCT images of the 60 eyes. The pRNFLT parameters are provided in Table 1. None of the subjects underwent treatment.

At the 6-month follow-up visit, the median VA and mean VFI were 0.30 (0.00, 0.70) logMAR and 69.27% ± 28.94%, respectively.

The demographic data, visual function parameters and other ocular parameters at the initial visit, pRNFLT parameters, and visual outcomes at the 6-month follow-up visit are summarized in Table 1.

Association Between pRNFLT Parameters and VA at the 6-Month Follow-Up Visit

There were 22 eyes (36.67%) and 38 eyes (63.33%) in the favorable VA and unfavorable VA groups, respectively. Compared with the eyes in the unfavorable VA group, those in the favorable VA group had a higher proportion of the absence of DM (72.73% versus 39.47%, *p* = 0.013). No significant differences were found between the groups with respect to the other demographic data, the VA parameter at the initial visit, or the other ocular parameters at the initial visit (*p* ≥0.05). The pRNFLT parameters of the favorable VA group were significantly thinner than those of the unfavorable VA group globally and in all four quadrants, as shown in Table 2.

The multivariate analysis showed that the absence of DM (odds ratio (OR) 6.55; *p* = 0.018), and thinner temporal-quadrant pRNFLT (OR 0.98; *p* = 0.042) were associated with favorable VA, as shown in Table 3.

Table 1 Demographic Data, Visual Function Parameters and Other Ocular Parameters at the Initial Visit, pRNFLT Parameters, and Visual Outcomes at the 6-Month Follow-Up Visit

Variables	Values
Number of subjects	60
Number of eyes	60
Demographic data	
Male, number of subjects (%)	29 (48.33%)
Age at onset, mean ± SD, years	58.83 ± 9.52
DM, number of subjects (%)	29 (48.33%)
HT, number of subjects (%)	42 (70.00%)
DLP, number of subjects (%)	39 (65.00%)
OSA, number of subjects (%)	11 (18.33%)
Smoking, number of subjects (%)	8 (13.33%)
Visual function parameters at the initial visit	
VA at the initial visit, median (IQR), logMAR	0.40 (0.40, 0.54)
VFI at the initial visit[a], mean ± SD, %	73.07 ± 6.73
Other ocular parameters at the initial visit	
IOP, mean ± SD, mmHg	14.00 ± 2.97
Contralateral C/D ratio, median (IQR), ratio	0.15 (0.10, 0.20)
pRNFLT parameters, µm	
Global, mean ± SD	208.00 ± 84.88
Superior quadrant, mean ± SD	241.77 ± 120.20
Inferior quadrant, mean ± SD	267.38 ± 116.51
Nasal quadrant, mean ± SD	151.08 ± 71.01
Temporal quadrant, median (IQR)	144.50 (93.50, 234.50)
Visual outcomes at the 6-month follow-up visit	
VA at the 6-month follow-up visit, median (IQR), logMAR	0.30 (0.00, 0.70)
VFI at the 6-month follow-up visit[b], mean ± SD, %	69.27 ± 28.94

Notes: [a]Reliable VFI values at the initial visit from 30 eyes for which reliable VFI values were obtained at both the initial and at 6-month follow-up visits. [b]Reliable VFI values at the 6-month follow-up visit from 30 eyes for which reliable VFI values were obtained at both the initial and at 6-month follow-up visits.
Abbreviations: pRNFLT, peripapillary retinal nerve fiber layer thickness; SD, standard deviation; DM, diabetes mellitus; HT, systemic hypertension; DLP, dyslipidemia; OSA, obstructive sleep apnea; VA, visual acuity; IQR, interquartile range; logMAR, logarithm of the minimum angle of resolution; VFI, visual field index; IOP, intraocular pressure; C/D, cup-to-disc.

The optimal cut-off value of the temporal-quadrant pRNFLT for the prediction of favorable VA was found to be 128 µm (area under the curve (AUC) 0.839, 95% CI: 0.732–0.947). The sensitivity and specificity of this temporal-quadrant pRNFLT cut-off value were 77.27% and 84.21%, respectively.

Table 2 Comparison of the Demographic Data, VA Parameter and Other Ocular Parameters at the Initial Visit, and pRNFLT Parameters for the Eyes with Favorable and Unfavorable VA

Variables	Favorable VA (N = 22 eyes)	Unfavorable VA (N = 38 eyes)	p-value
Demographic data			
Male, number of eyes (%)	11 (50.00%)	18 (47.37%)	0.844
Age at onset, mean ± SD, years	56.52 ± 9.23	60.17 ± 9.54	0.153
Absence of DM, number of eyes (%)	16 (72.73%)	15 (39.47%)	0.013*
Absence of HT, number of eyes (%)	8 (36.36%)	10 (26.32%)	0.413
Absence of DLP, number of eyes (%)	10 (45.45%)	11 (28.95%)	0.196
Absence of OSA, number of eyes (%)	18 (81.82%)	31 (81.58%)	1.000
Absence of smoking, number of eyes (%)	18 (81.82%)	34 (89.47%)	0.449
VA parameter and other ocular parameters at the initial visit			
VA at the initial visit, median (IQR), logMAR	0.40 (0.30, 0.48)	0.40 (0.40, 0.88)	0.163
IOP, mean ± SD, mmHg	13.68 ± 3.36	14.18 ± 2.75	0.532
Contralateral C/D ratio, median (IQR), ratio	0.20 (0.10, 0.20)	0.10 (0.10, 0.20)	0.583
pRNFLT parameters, μm			
Global, mean ± SD	151.36 ± 62.11	240.79 ± 79.29	<0.001*
Superior quadrant, mean ± SD	183.45 ± 78.44	275.53 ± 127.88	0.001*
Inferior quadrant, mean ± SD	197.64 ± 96.68	307.76 ± 108.51	<0.001*
Nasal quadrant, median (IQR)	97.50 (77.00, 182.00)	168.00 (123.00, 207.00)	0.004*
Temporal quadrant, median (IQR)	82.00 (69.00, 128.00)	177.50 (140.00, 287.00)	<0.001*

Note: *Statistically significant (p <0.05).
Abbreviations: VA, visual acuity; pRNFLT, peripapillary retinal nerve fiber layer thickness; N, number; SD, standard deviation; DM, diabetes mellitus; HT, systemic hypertension; DLP, dyslipidemia; OSA, obstructive sleep apnea; IQR, interquartile range; logMAR, logarithm of the minimum angle of resolution; IOP, intraocular pressure; C/D, cup-to-disc.

Table 3 Factors Associated with Favorable VA

Variables	Univariate Analysis		Multivariate Analysis	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Demographic data				
Sex (male)	1.11 (0.39–3.18)	0.844		
Age at onset (years)	0.96 (0.90–1.02)	0.156		
Absence of DM	4.09 (1.31–12.81)	0.016*	6.55 (1.38–31.08)	0.018*
Absence of HT	1.60 (0.52–4.95)	0.415		
Absence of DLP	2.05 (0.69–6.11)	0.200		
Absence of OSA	1.02 (0.26–3.95)	0.982		
Absence of smoking	0.53 (0.12–2.37)	0.406		

Table 3 (Continued).

Variables	Univariate Analysis		Multivariate Analysis	
	OR (95% CI)	*p*-value	OR (95% CI)	*p*-value
VA parameter and other ocular parameters at the initial visit				
VA at the initial visit (logMAR)	0.50 (0.07–3.51)	0.489		
IOP (mmHg)	0.94 (0.79–1.13)	0.525		
Contralateral C/D ratio (ratio)	11.01 (0.09–1419.14)	0.333		
pRNFLT parameters (μm)				
Superior quadrant	0.99 (0.98–0.99)	0.008*	1.00 (0.99–1.01)	0.772
Inferior quadrant	0.99 (0.98–0.99)	0.001*	0.99 (0.98–1.00)	0.075
Nasal quadrant	0.99 (0.98–0.99)	0.008*	0.99 (0.98–1.02)	0.652
Temporal quadrant	0.98 (0.97–0.99)	0.001*	0.98 (0.97–0.99)	0.042*

Note: *Statistically significant (p <0.05).
Abbreviations: VA, visual acuity; OR, odds ratio; CI, confidence interval; DM, diabetes mellitus; HT, systemic hypertension; DLP, dyslipidemia; OSA, obstructive sleep apnea; logMAR, logarithm of the minimum angle of resolution; IOP, intraocular pressure; C/D, cup-to-disc; pRNFLT, peripapillary retinal nerve fiber layer thickness.

Association Between pRNFLT Parameters and VF at the 6-Month Follow-Up Visit

Of the 30 eyes for which reliable VFI values were obtained at both the initial and at 6-month follow-up visits, 10 eyes (33.33%) and 20 eyes (66.67%) were in the favorable VF and unfavorable VF groups, respectively. There were no significant differences in the demographic data, the VF parameter at the initial visit, or the other ocular parameters at the initial visit between the two groups (p ≥0.05). The pRNFLT parameters of the favorable VF group were significantly thinner than those of the unfavorable VF group globally and in the superior and nasal quadrants, as shown in Table 4.

The multivariate analysis showed that thinner nasal-quadrant pRNFLT (OR 0.97; p = 0.047) was associated with favorable VF, as shown in Table 5.

Table 4 Comparison of the Demographic Data, VF Parameter and Other Ocular Parameters at the Initial Visit, and pRNFLT Parameters for the Eyes with Favorable and Unfavorable VF

Variables	Favorable VF (N = 10 eyes)	Unfavorable VF (N = 20 eyes)	*p*-value
Demographic data			
Male, number of eyes (%)	5 (50.00%)	13 (65.00%)	0.461
Age at onset, mean ± SD, years	62.49 ± 9.61	55.99 ± 8.07	0.061
Absence of DM, number of eyes (%)	6 (60.00%)	14 (70.00%)	0.690
Absence of HT, number of eyes (%)	4 (40.00%)	6 (30.00%)	0.690
Absence of DLP, number of eyes (%)	6 (60.00%)	8 (40.00%)	0.442
Absence of OSA, number of eyes (%)	9 (90.00%)	15 (75.00%)	0.633
Absence of smoking, number of eyes (%)	8 (80.00%)	16 (80.00%)	1.000

(*Continued*)

Table 4 (Continued).

Variables	Favorable VF (N = 10 eyes)	Unfavorable VF (N = 20 eyes)	p-value
VF parameter and other ocular parameters at the initial visit			
VFI at the initial visit, mean ± SD, %	75.50 ± 7.63	71.85 ± 6.07	0.165
IOP, mean ± SD, mmHg	13.40 ± 2.95	13.50 ± 3.02	0.932
Contralateral C/D ratio, median (IQR), ratio	0.20 (0.20, 0.30)	0.10 (0.10, 0.20)	0.061
pRNFLT parameters, µm			
Global, mean ± SD	143.00 ± 44.25	195.60 ± 70.67	0.041*
Superior quadrant, mean ± SD	167.50 ± 51.45	228.95 ± 109.32	0.046*
Inferior quadrant, median (IQR)	185.00 (142.00, 233.00)	208.50 (144.00, 325.00)	0.367
Nasal quadrant, mean ± SD	87.10 ± 22.00	151.05 ± 61.25	<0.001*
Temporal quadrant, median (IQR)	82.00 (70.00, 125.00)	134.00 (96.00, 228.50)	0.058

Note: *Statistically significant (p <0.05).
Abbreviations: VF, visual field; pRNFLT, peripapillary retinal nerve fiber layer thickness; N, number; SD, standard deviation; DM, diabetes mellitus; HT, systemic hypertension; DLP, dyslipidemia; OSA, obstructive sleep apnea; VFI, visual field index; IOP, intraocular pressure; C/D, cup-to-disc; IQR, interquartile range.

Table 5 Factors Associated with Favorable VF

Variables	Univariate Analysis		Multivariate Analysis	
	OR (95% CI)	p-value	OR (95% CI)	p-value
Demographic data				
Sex (male)	0.54 (0.12–2.52)	0.432		
Age at onset (years)	1.09 (0.99–1.20)	0.075	1.09 (0.97–1.23)	0.141
Absence of DM	0.64 (0.13–3.14)	0.585		
Absence of HT	1.56 (0.32–7.60)	0.585		
Absence of DLP	2.25 (0.48–10.60)	0.305		
Absence of OSA	3.00 (0.30–29.94)	0.349		
Absence of smoking	1.00 (0.15–6.67)	1.000		
VF parameter and other ocular parameters at the initial visit				
VFI at the initial visit (%)	1.09 (0.97–1.23)	0.167		
IOP (mmHg)	0.99 (0.76–1.28)	0.929		
Contralateral C/D ratio (ratio)	15.95 (0.04–7186.62)	0.374		
pRNFLT parameters (µm)				
Superior quadrant	0.99 (0.98–1.00)	0.113		
Inferior quadrant	0.99 (0.99–1.00)	0.441		
Nasal quadrant	0.97 (0.95–0.99)	0.017*	0.97 (0.95–0.99)	0.047*
Temporal quadrant	0.99 (0.98–1.00)	0.096	0.99 (0.98–1.01)	0.882

Note: *Statistically significant (p <0.05).
Abbreviations: VF, visual field; OR, odds ratio; CI, confidence interval; DM, diabetes mellitus; HT, systemic hypertension; DLP, dyslipidemia; OSA, obstructive sleep apnea; VFI, visual field index; IOP, intraocular pressure; C/D, cup-to-disc; pRNFLT, peripapillary retinal nerve fiber layer thickness.

The optimal cut-off value of the nasal-quadrant pRNFLT for the prediction of favorable VF was found to be 105 μm (AUC 0.780, 95% CI: 0.612–0.948). The sensitivity and specificity of this nasal-quadrant pRNFLT cut-off value were 90.00% and 70.00%, respectively.

Discussion

In the present study, we evaluated the utility of pRNFLT, both globally and separately in all four quadrants, for the prediction of visual outcomes, including VA and VF, in subjects with acute NAION. We found that the ability of pRNFLT to predict a favorable VA was best when measured in the temporal quadrant. Of the pRNFLT parameters, a thinner temporal-quadrant pRNFLT was the only parameter that was found to be associated with favorable VA.

We speculate that this finding can be explained by the temporal-quadrant pRNFLT being representative of the papillomacular bundle (PMB), and visual outcome (VA) deficit may depend on the severity of the damage sustained by the PMB. For example, the less severe is the damage to the PMB, and therefore the thinner is the temporal-quadrant pRNFLT, the less severe is the visual outcome (VA) deficit. In one retrospective study, in which only eyes with chronic NAION were studied, VA (logMAR) showed a strong negative correlation with the temporal-quadrant pRNFLT (μm), whereas there were no correlations between the global and other quadrants of pRNFLT and VA.[21] This finding is consistent with the present finding that the temporal-quadrant pRNFLT may be a predictor of visual outcome (VA) in subjects with acute NAION. However, in the previous study, only eyes with chronic NAION were studied, and therefore there was a negative correlation between VA (logMAR) and the temporal-quadrant pRNFLT (μm).

Interestingly, we found that the absence of DM was associated with favorable VA, which is fairly similar to the results of a study of Kemchoknatee et al, in which only eyes with acute NAION were studied in Thailand and showed that the presence of DM is a predictor of a poor improvement in VA.[16]

We also found that the ability of pRNFLT to predict a favorable VF was best when measured in the nasal quadrant. Of the pRNFLT parameters, a thinner nasal-quadrant pRNFLT was the only parameter that was found to be associated with favorable VF. Papchenko et al found that of the pRNFLT parameters, the nasal-quadrant pRNFLT (μm) showed the highest positive correlation with the severity of the VF defect in eyes with chronic NAION, assessed using the total mean deviation (MD) (decibels (dB)).[22] This finding is consistent with the present finding that the nasal-quadrant pRNFLT may be a predictor of visual outcome (VF) in subjects with acute NAION. However, in the previous study, only eyes with chronic NAION were studied, and therefore there was a positive correlation between the nasal-quadrant pRNFLT (μm) and the severity of the VF defect, assessed using the total MD (dB).

In the present study, we have established cut-off values of pRNFLT for the prediction of favorable VA and VF in the Thai population. These cut-off values could be used by ophthalmologists and neurologists to provide better information regarding the visual prognosis of patients, which is an important part of the therapeutic approaches of acute NAION, owing to the lack of proven effective treatments for acute NAION.

The present study had several strengths. First, to the best of our knowledge, this was the first study among the Thai population to identify associations between pRNFLT and visual outcomes in subjects with acute NAION. Moreover, it was also the first study among the Thai population to identify predictors of VF in such subjects. Second, the visual outcomes assessed included both VA and VF. Finally, we have identified optimal cut-off values of pRNFLT for the prediction of favorable VA and VF.

There were some limitations in the present study. First, we did not evaluate other aspects of visual function, such as contrast sensitivity. Second, we did not evaluate the vascular density of the optic disc using OCT angiography and the macular ganglion cell complex. Finally, visual outcomes were not assessed after the 6-month follow-up visit.

Conclusions

The pRNFLT is a clinically useful means of predicting visual outcomes in patients with acute NAION. A temporal-quadrant pRNFLT ≤128 μm and a nasal-quadrant pRNFLT ≤105 μm were found to predict favorable VA and VF at the 6-month follow-up visit, respectively.

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Disclosure

The authors declare that they have no competing interests in this work.

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