

Clinical and Multimodal Imaging of Idiopathic Polypoidal Choroidal Vasculopathy in Tertiary Eye Hospital

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ABSTRACT

Introduction: Idiopathic Polypoidal Choroidal Vasculopathy is a distinct variant of neovascular age-related macular degeneration prevalent in Asian populations. This study aimed to describe the demographic, clinical, and multimodal imaging characteristics of patients with treatment-naïve Idiopathic Polypoidal Choroidal Vasculopathy.

Methods: A descriptive cross-sectional study included 25 patients diagnosed with Idiopathic Polypoidal Choroidal Vasculopathy at tertiary eye hospital between from June 2022 to May 2023. Data were collected included age, sex, best corrected visual acuity, fundus photography and spectral-domain optical coherence tomography (OCT) and OCT angiography feature such as choroidal thickness, polyp location, presence of subretinal fluid, and specific signs like sharp-peaked pigment epithelial detachments and the double-layer sign. Branching vascular network type was classified based on OCT angiography.

Results: The mean age of patients was 65.4 ± 8.9 years, with a female predominance (56.0%). The mean log MAR BCVA was 0.66 ± 0.24 . The mean sub foveal choroidal thickness was $372.5 \pm 45.3 \mu\text{m}$. A sharp-peaked PED, internal reflectivity, and the double-layer sign were present in all eyes (100%). Subretinal fluid was present in 84% of eyes. Type II (glomerular) BVN was the most common (44.0%), and juxta foveal was the most common polyp location (48.0%). Choroidal thickness was significant with Type III (stick) BVN type ($p=0.03$). Eyes with sub foveal polyps had significantly worse VA than those with non-sub foveal polyps (0.80 vs. 0.61 log MAR, $p=0.04$).

Conclusions: A positive correlation between age and choroidal thickness contrasts with the usual age-related thinning and defines the pachychoroid nature of PCV. The association between poorer vision and sub foveal polyp location, along with differences in choroidal thickness by BVN type, reflects the disease's clinical variability.

Keywords: *branching vascular network; choroidal thickness; spectral-domain OCT; polypoidal choroidal vasculopathy.*

INTRODUCTION

Polypoidal choroidal vasculopathy (PCV) causes sight loss in elderly population. Asian population has high prevalence rate (22-62%) of PCV among presumed age-related macular degeneration (nAMD).¹ In resource-limited settings where indocyanine green angiography (ICGA) is unavailable, polypoidal choroidal vasculopathy (PCV) can still be diagnosed with high confidence using non-invasive imaging fundus photography, spectral-domain optical coherence tomography (SD-OCT) and OCT angiography. The cornerstone is spectral-domain optical coherence tomography (SD-OCT), where specific findings like sharply peaked pigment epithelial detachments (PEDs), double

layer sign and sub-RPE hyperreflective nodules are highly suggestive of PCV. OCT angiography can visually confirm the abnormal polypoidal lesions and branching vascular network without dye injection.

De Salvo et al. examined 51 eyes with PED resulting from either PCV or occult choroidal neovascularization, reporting a sensitivity of 0.946 and a specificity of 0.929 for identifying PCV with spectral domain OCT.² Liu et al. found that OCT could tell the difference between PCV and conventional nvAMD with 0.875 sensitivity and 0.862 specificity in a prospective analysis. The OCT findings that pointed to a diagnosis of PCV were PED, double-layer sign, and thumb-like PED.³ Chaikitmongkol et al. described

0.95 sensitivity and 0.95 specificity using noninvasive methods including optical coherence tomography (OCT). They applied diagnostic criteria with, which used at least 2 of 4 signs: hemorrhagic PED on FP, notched PED on OCT, sharply peaked PED (also known as thumb-like PED in the current study) on OCT, and hyperreflective ring (also known as bubble sign in the current study) on OCT.⁴ The APOIS PCV Workgroup's (2019) criteria, based on a combined optical coherence tomography (OCT) and color fundus photography had great accuracy (82%) and a high area under the receiver operating characteristic curve (AUC) of 0.90 for the diagnosis of PCV.⁵

The study's goal was to identify the demographic and imaging characteristics of IPCV in a Nepalese population presenting in a hospital who had neovascular AMD-like symptoms.

METHODS

This observational study was recorded and imaging data of 25 patients diagnosed with PCV at tertiary eye hospital from June 2022 to May 2023. The study was approved by the Institutional Review Committee (Ref.:2905202207). Inclusion criteria were: (1) a diagnosis of PCV confirmed by OCT and OCTA showing focal polypoidal lesions with a BVN; (2) availability of high-quality SD-OCT scans at presentation; and (3) treatment-naïve status. Exclusion criteria included: (1) presence of other concomitant retinal diseases (e.g., diabetic retinopathy, retinal vein occlusion); (2) media opacities precluding quality imaging; and (3) history of any previous treatment for nAMD. Demographic data (age, sex) and best-corrected visual acuity (BCVA) at presentation were recorded. BCVA was measured using a Snellen chart and converted to the logarithm of the minimum angle of resolution (logMAR) for statistical analysis. All patients underwent retinal fundus photography by Canon digital retinal fundus camera and SD-OCT and OCT angio (Spectralis OCT, Heidelberg Engineering). SD-OCT images were analyzed for the following features:

1. Choroidal Thickness: Manually measured subfoveally from the outer portion of the hyperreflective RPE line to the choroid-scleral junction by single investigator(OB),
2. Polyp Location: Classified as subfoveal, juxtafoveal (within 200 μ m of the fovea), or extrafoveal.
3. SD-OCT Signs: Presence of a sharp-peaked PED, moderate internal reflectivity within the PED, and the double-layer sign.
4. Subretinal Fluid (SRF): Recorded as present or absent. OCTA images were used to classify the type of branching vascular network (BVN) according to the Japanese Expert consensus [Type I(Trunk), II (Glomeruli), or III(Stick)].¹¹

Statistical analysis was performed using SPSS version 21.

A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 25 eyes from 25 patients were included in the study. The mean age of the patients was 65.4 ± 8.9 years. The study included 11 (44.0%) males and 14 (56.0%) females. The mean preoperative logMAR visual acuity was 0.66 ± 0.24 . The demographic and clinical characteristics are summarized in Table 1. The analysis of SD-OCT and OCTA features is summarized in Table 2. The universal findings were the presence of a sharp-peaked PED (100%), internal reflectivity within the PED (100%), and the double-layer sign (100%). Subretinal fluid was present in 21 eyes (84.0%). The mean subfoveal choroidal thickness was $372.5 \pm 45.3 \mu$ m. Based on OCTA, Type II BVN was the most common (11 eyes, 44.0%), followed by Type I (8 eyes, 32.0%) and Type III (6 eyes, 24.0%). Regarding polyp location, juxtafoveal was most frequent (12 eyes, 48.0%), followed by subfoveal (7 eyes, 28.0%) and extrafoveal (6 eyes, 24.0%). A significant positive correlation was found between patient age and subfoveal choroidal thickness ($r = 0.43$, $p = 0.037$). No significant correlations were found between visual acuity and age ($r = 0.19$, $p = 0.37$) or between visual acuity and choroidal thickness ($r = -0.16$, $p = 0.45$). Choroidal thickness varied significantly based on BVN type ($p = 0.03$). Post-hoc analysis indicated that eyes with a Type III BVN had a greater mean choroidal thickness (407.3μ m) compared to those with Type II (355.4μ m). There was a non-significant trend towards greater choroidal thickness in male patients (389.2μ m vs. 359.6μ m, $p = 0.10$). Visual acuity was significantly worse in eyes with subfoveal polyp involvement (mean logMAR 0.80) compared to those with juxtafoveal or extrafoveal polyps (mean logMAR 0.61, $p = 0.04$). The presence or absence of subretinal fluid did not significantly influence visual acuity ($p = 0.28$) or choroidal thickness ($p = 0.38$).

Table 1. Demographic and Clinical Characteristics of the PCV(N=25)

Characteristic	Value
Age (years), mean $\pm$ SD	65.4 ± 8.9
Sex, n (%)	
Male	11 (44.0)
Female	14 (56.0)
Eye, n (%)	
Right Eye (OD)	8 (32.0)
Left Eye (OS)	17 (68.0)
Preop VA (logMAR), mean $\pm$ SD	0.66 ± 0.24

Table 2: Multimodal Imaging Characteristics of the PCV(N=25)

Characteristic	N	%
BVN Type		
Type I	8	32.0
Type II	11	44.0
Type III	6	24.0
Polyp Location		
Subfoveal	7	28.0
Juxtafoveal	12	48.0
Extrafoveal	6	24.0
SD-OCT Features		
Sharp-peaked PED	25	100.0
Internal Reflectivity	25	100.0
Double Layer Sign	25	100.0
Subretinal Fluid	21	84.0
Choroidal Thickness (μm), mean ± SD (n=24)*	372.5 ± 45.3	

DISCUSSION

This study provides a detailed analysis of the clinical and imaging features in 25 eyes of 25 patients with treatment-naïve PCV. Our findings reinforce several well-established characteristics of the disease and reveal some interesting associations.

The universal presence of key SD-OCT features—the sharp-peaked PED, internal reflectivity, and the double-layer sign—in our study (100% for each) highlights the critical role of OCT in the non-invasive diagnosis of PCV.² The Asia Pacific Ocular Imaging Society (APOIS) PCV workgroup found that combining three OCT-based criteria (sub-retinal pigment epithelium [RPE] ring-like lesion, complex RPE outline on enface OCT, and a sharp-peaked pigment epithelial detachment [PED]) can differentiate PCV from typical nAMD in treatment-naïve eyes with a sensitivity of 0.75 and specificity of 0.91.⁵

De Salvo et al reported that using a combination of three of the four OCT-based signs—multiple PEDs, sharp PED peak, PED notch, and rounded sub-RPE hyporeflective area—they were able to diagnose PCV with a sensitivity of 94.6% and specificity of 92.9% in a cohort of 51 patients from the United Kingdom.

The mean subfoveal choroidal thickness in this study was 372.5 μm, which is markedly thicker than typical values reported in healthy age-matched eyes or even in eyes with nAMD, solidifying PCV's position within the pachychoroid disease spectrum.^{2,7}

Eyes with PCV had considerably higher mean (±SD) subfoveal choroidal thickness compared to age-matched normal participants.⁶

Among 98 eyes with treatment-naïve PCV, 34 eyes with choroidal vascular hyperpermeability had significantly higher subfoveal thickness than the 64 eyes without choroidal vascular hyperpermeability ($P < .001$).⁸

The most intriguing finding was the significant positive correlation between increasing age and choroidal thickness ($r=0.43$, $p=0.037$). This is counterintuitive, as choroidal thickness normally decreases with age.⁹ This paradox underscores the primary pathological role of choroidal vascular hyperpermeability and congestion in PCV, a process that may overpower the general tendency for age-related thinning.

Our investigation revealed significant anatomic and functional variability within PCV. Choroidal thickness differed considerably by BVN type, with Type III lesions having the thickest choroids. This shows that BVN type may have ramifications for the underlying choroidal anatomy, and possibly disease behaviour. Furthermore, as expected, functional impact was clearly connected to anatomy: eyes with subfoveal polyps had considerably lower visual acuity at presentation than those with non-subfoveal involvement, underlining the vital role of the foveal photoreceptors for visual function.¹⁰

This study has relatively small sample size to limit the generalizability of the findings. The absence of a control group (e.g., typical nAMD) prevents direct comparative analysis of these features to distinguish PCV more clearly. Further large population based study is necessary in future to solidify the results.

CONCLUSIONS

Finally, our findings support the traditional multimodal imaging profile of PCV and provide additional evidence of its pachychoroid origin. The clinical and structural variability of PCV is highlighted by the correlations between variances in choroidal thickness by BVN type and lower visual acuity and subfoveal polyp placement. Understanding these relationships is crucial for improving diagnosis, prognostic stratification, and tailoring treatment approaches for this complex condition.

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