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Original article

# Clinical characteristics and visual outcome of macular hemorrhage in pathological myopia with or without choroidal neovascularization

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ABSTRACT

*Background/Purpose:* This study aims to evaluate the clinical characteristics and visual outcome of macular hemorrhage in pathological myopia with or without choroidal neovascularization.
*Methods:* We conducted a retrospective study of 55 patients with macular coin hemorrhage who were followed for at least 3 months from January 1997 to December 2013 at Shin Kong Wu Ho-Su Memorial Hospital (Taipei, Taiwan). All patients were evaluated using fluorescein angiography and optical coherence tomography for the detection of choroidal neovascularization (CNV). We also recorded clinical characteristics such as age, sex, refractory error, and myopic fundus, to determine the relationship between CNV and non-CNV associated macular hemorrhage.
*Results:* A total of 55 patients (30 females, 54.55%) were reviewed. The mean age was 39.7 years old. The CNV group was found to be significantly older than the non-CNV group ($p < 0.05$), and there was no significant difference between sex, visual acuity myopic severity, and the prevalence of fundus findings between CNV and non-CNV groups. Twenty one patients (38.18%) were found to have CNV and were all treated with intravitreal antivascular endothelial growth factor (VEGF). The other 34 patients without CNV were not treated. In both groups, the visual acuity significantly improved (anti-VEGF treated, CNV associated group, 0.7 to 0.39, $p = 0.002$, and untreated, non-CNV associated group, 0.56 to 0.34, $p = 0.0018$, respectively).
*Conclusion:* Age significantly correlated to the CNV formation in high myopia with macular hemorrhage. Favorable visual outcomes were found in pathological myopic macular hemorrhage either in the anti-VEGF treated, CNV associated group or in the untreated, non-CNV associated group.


## 1. Introduction

Pathologic myopia (PM) is a major vision-threatening morbidity throughout the world and has been found to be increasing in frequency in many countries, especially in Asia. It is estimated to affect 1.4–2.5% of the general population in Western countries,[1–3] and 6.8–26% in East Asia,[4–7] including Korea, China, and Taiwan. A higher prevalence was found in younger generations, or people living in urban areas in these countries.[4–7] Consequently, complications of pathological myopia may pose great socioeconomic impacts in East Asian countries because it can lead to vision loss in people of working age.[5] One of the major complications of PM is macular hemorrhage, which often presents with sudden impairment of visual acuity (VA) in the affected patients. The pathogenesis of macular hemorrhage in PM may be related to either simple rupture of Bruch's membrane, or a bleeding from concurrent choroidal neovascularization (CNV). The presence of CNV is particularly detrimental to long-term visual function when involved in the foveal area, because it would usually lead to scar formation,[8] as in age-related macular degeneration (AMD) or other choroidal pathologies. Recently, inhibitors of vascular endothelial growth factor (VEGF) have been used for the treatment of CNV in PM with good results.[8] As a result, prompt detection of the concurrence of CNV in PM patients presenting with macular hemorrhage is of great importance in regard to treatment choices and prognosis. The purpose of this study is to identify the clinical

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characteristics and visual prognosis of macular hemorrhage in PM patients with or without choroidal neovascularization.

## 2. Methods

We conducted a retrospective chart review of 55 patients with PM and subretinal coin hemorrhage at Shin Kong Wu Ho-Su Memorial Hospital, Taipei, Taiwan, between 1997 and 2013. The study passed the institutional review board of our hospital and was conducted according to the principles of the Declaration of Helsinki for human participants. The inclusion criteria comprised:

1. Patients with at least one of the following conditions: (a) refractive error < −6 D when the macular hemorrhage was found; (b) previous documented refractive data < −6 D before receiving refractive surgery or cataract surgery; (c) axial length > 26.5 mm of the involved eye.
2. The fundus of patients in which characteristic findings suggested pathological myopia, such as tessellated fundus, geographic atrophy, posterior staphyloma, lacquer cracks and Fuchs' spot formation.

The subretinal hemorrhage was defined as one or more reddish spots found in the subfoveal and juxtafoveal (<200 μm from the fovea center) area in the ophthalmoscopic examination and recorded in the color fundus photographs. Our study excluded patients suspected to have AMD, any retinal vasculopathies (including diabetic retinopathy, retinal vein occlusions, retinal vasculitis, etc.), advanced glaucoma, or intraocular pressure in the study eye >22 mmHg despite adequate treatment, and acute ocular or periocular infection. Recurrence of macular hemorrhage was defined as the reappearance of any macular hemorrhage after a complete absorption of the previous macular hemorrhage in any follow-up visit.

Differentiation of macular hemorrhage associated with or without myopic CNV was made by a combination of fluorescein angiography (FA) (Heidelberg Retina Angiograph2; Heidelberg engineering, Heidelberg, Germany) and optical coherence tomography (OCT) (Stratus, Zeiss, Model 3000; Carl Zeiss Meditec, Inc., Dublin, CA, USA) modified from previous published literature.[9,10] The diagnostic criteria for CNV in FA included a patch of lacy or irregular hyperfluorescence in the early arteriovenous phase, leakage of dye from the lesion in the late arteriovenous phase, and staining of the lesion with fluorescein in the late phase. In most cases, a hyperpigmented ring was found around the hyperfluorescent CNV. The OCT criteria for CNV included an elevated submacular hyperreflective lesion with evidence of exudative characteristics, including subretinal fluid, macular thickening, or retinal cysts (Figure 1). Macular hemorrhage without myopic CNV was defined as flat or elevated submacular hyperreflective lesions without evidence of exudative characteristics on OCT, and hypofluorescence of lesion without accompanying dye staining, leakage, and hyperfluorescence on FA (Figure 2).

If myopic CNV was detected, further intravitreal injection of anti-VEGF was arranged. Otherwise, the non-CNV patients were only observed.

In this study, we aimed to identify the visual outcomes and accompanying findings in patients with and without myopic CNV. We evaluated the patients' best corrected visual acuity (BCVA) during every visit using a Snellen chart in a standard condition. BCVA was then converted to logarithm of minimal angle of resolution (logMAR) for statistical analysis. The Mann–Whitney *U* test was used to assess the numerical clinical characteristics, such as age and refraction, between CNV and non-CNV groups. A paired *t*-test was used to compare changes in VA from baseline to the 3-month follow up in all patients within both myopic CNV and non-CNV groups. The categorical clinical characteristics, including sex, lacquer cracks, Fuchs' spot, and geographic atrophy were compared using a Chi-squared test. Values of $p < 0.05$ were considered statistically significant.

## 3. Results

A total of 55 eyes in 55 patients (30 females, 54.55%) who had PM with macular hemorrhage were included in this study. The

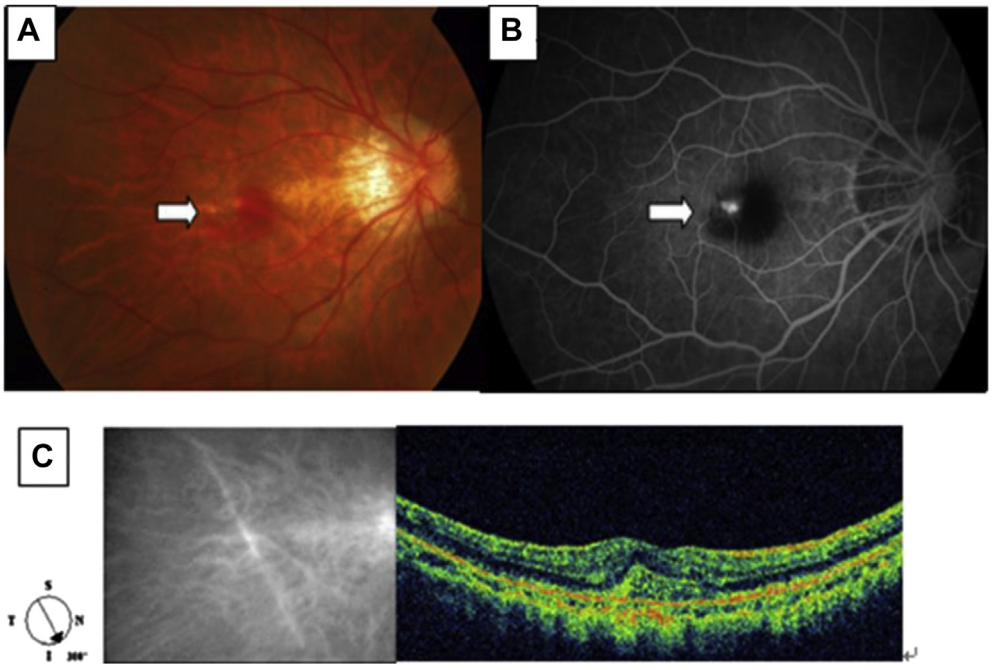


**Figure 1.** A 46-year-old woman with macular hemorrhage due to myopic choroidal neovascularization (arrows in A and B). (A) Color fundus; (B) fluorescein angiography; and (C) time-domain optical coherence tomography.