



ORIGINAL RESEARCH ARTICLE

Angiographic Classification of Choroidal Neovascularization Patterns in Newly Diagnosed Neovascular Age-Related Macular Degeneration and Their Relationship to Baseline Visual Acuity: A Retrospective Single-Institution Study

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Abstract

Background: Fundus fluorescein angiography (FA) has long served as the reference standard for identifying and classifying choroidal neovascularization (CNV) in neovascular age-related macular degeneration (AMD), distinguishing classic from occult leakage patterns that carry different prognostic and treatment implications, but institutional data describing the distribution of these angiographic patterns and their relationship to baseline visual acuity are useful for local benchmarking. **Methods:** We designed a retrospective, single-center study (simulated for this exercise) of patients with newly diagnosed neovascular AMD undergoing FA over a one-year period at a hypothetical retina clinic, describing the distribution of classic, occult, and minimally classic CNV patterns and their association with baseline best-corrected visual acuity. **Results:** In this simulated dataset (n = 298 eyes), occult CNV was the most common angiographic pattern (46.6%), followed by minimally classic (29.5%) and predominantly classic (23.9%) lesions. Mean baseline best-corrected visual acuity was worst in the predominantly classic subgroup (20/80 Snellen equivalent) and best in the occult subgroup (20/50). **Conclusion:** These illustrative findings are consistent with the published literature (through 2014) in supporting fluorescein angiography as a clinically important tool for classifying CNV lesion composition in neovascular AMD, with continued relevance for cases in which optical coherence tomography findings are ambiguous. **Keywords:** fluorescein angiography, neovascular, macular, epithelium, retina

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1 | INTRODUCTION

Neovascular (exudative) age-related macular degeneration is a leading cause of severe central vision loss in older adults, resulting from the growth of abnormal choroidal blood vessels beneath the retinal pigment epithelium and neurosensory retina (1). Fundus fluorescein angiography was historically the reference standard for detecting and classifying choroidal neovascularization, distinguishing well-demarcated classic lesions, characterized by early, bright, progressively leaking hyperfluorescence, from occult lesions, characterized by irregular, poorly demarcated, stippled late hyperfluorescence of less certain origin (2, 3).

This angiographic classification carried substantial prognostic and, historically, treatment-selection importance, since major randomized trials of thermal laser photocoagulation and photodynamic therapy defined eligibility according to classic-versus-occult lesion composition (4–7). While optical coherence tomography has since become the first-line imaging modality for diagnosing and monitoring neovascular AMD, FA retains a role in select cases where OCT findings are ambiguous or where lesion classification is needed for confirmation (8). This study was designed, as a hypothetical exercise, to describe the distribution of angiographic CNV patterns and their relationship to baseline visual acuity within a single simulated institutional cohort of patients with newly diagnosed neovascular AMD over a one-year period.

1.1 | Study Objectives

The aims of this study were: (1) to describe the distribution of predominantly classic, minimally classic, and occult CNV angiographic patterns among eyes with newly diagnosed neovascular AMD; and (2) to compare mean baseline best-corrected visual acuity across these three angiographic pattern categories.

2 | METHODS

2.1 | Study Design and Setting

This was designed as a retrospective, descriptive, single-institution cohort study set at a hypothetical academic retina clinic with a standardized fluorescein angiography protocol. The simulated study period spanned twelve consecutive months. No real patient-level data were collected for this exercise; cohort size and finding distributions were constructed to fall within ranges reported in the published pre-2014 CNV angiographic classification literature (4–7).

2.2 | Study Population and Imaging Protocol

The simulated cohort included eyes of patients with newly diagnosed, treatment-naïve neovascular AMD undergoing standard-protocol fundus fluorescein angiography, consistent with classification methodology used in the Macular Photocoagulation Study and subsequent photodynamic therapy trials (4–7). Lesion composition was simulated as having been classified into predominantly classic (greater than 50% classic CNV component), minimally classic (some classic component present, but less than 50%), or occult with no classic component, consistent with standard trial-based classification criteria (4, 5).

2.3 | Outcome Definitions

Each eye was assigned to a single predominant angiographic lesion category based on the proportion of classic versus occult CNV present, consistent with methodology used in prior photodynamic therapy trial classification systems (4, 5). Baseline best-corrected visual acuity was recorded and converted to Snellen equivalent for each eye at the time

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of angiographic diagnosis, consistent with outcome measures used in prior CNV natural-history and treatment-trial literature (6, 7).

2.4 | Statistical Analysis

Descriptive statistics (counts, percentages, and means) were used to summarize lesion pattern distribution and baseline visual acuity by category. Given the illustrative nature of this exercise, no formal inferential hypothesis testing was performed across pattern categories. All summary statistics were generated for this academic exercise rather than derived from an underlying patient-level dataset.

3 | RESULTS

3.1 | Distribution of Angiographic CNV Patterns

Over the simulated one-year study period, 298 eyes with newly diagnosed neovascular AMD underwent fluorescein angiography. Figure 1 schematically illustrates the classic versus occult angiographic leakage patterns, and Table 1 summarizes their distribution and associated baseline visual acuity within this simulated cohort.

3.2 | Summary of Findings

In this simulated dataset, occult CNV was the most common lesion pattern and was associated with the best mean baseline visual acuity, while predominantly classic lesions, though less common, were associated with the worst mean baseline visual acuity.

4 | DISCUSSION

The lesion pattern distribution observed in this simulated dataset is broadly consistent with prior trial-based angiographic classification literature, in which occult and minimally classic lesions collectively outnumbered predominantly classic lesions in unselected neovascular AMD populations (4–6). The visual acuity pattern observed here, with predominantly classic lesions associated with worse base-

line acuity, is consistent with prior descriptions of classic CNV as a more aggressive, rapidly leaking lesion subtype often associated with more acute and severe vision loss at presentation, compared with the more indolent course sometimes seen with occult lesions (2, 6).

These findings, if replicated in a real dataset, would reinforce the historical clinical importance of angiographic lesion classification, and would be consistent with continued literature describing a role for FA, alongside OCT, (9–12) when angiographic confirmation of lesion activity or composition is needed, even as OCT has become the dominant first-line imaging modality in contemporary neovascular AMD management (8, 13). (14, 15)

4.1 | Limitations

The central limitation of this study is that it is a hypothetical exercise using simulated rather than real patient-level data, and the specific numerical results should not be cited as findings from an actual completed study. As designed, the study would also carry the usual limitations of a single-center, retrospective, descriptive design: lesion classification was forced into a single predominant category for simplicity, and inter-reader variability in angiographic interpretation was not assessed. In addition, as specifically requested for this exercise, only sources published in 2014 or earlier were cited; more recent literature, including OCT angiography-based CNV classification, exists and would ordinarily inform a current clinical discussion.

4.2 | Future Directions

A genuine version of this study would benefit from correlating angiographic lesion pattern with anti-VEGF treatment response and long-term visual outcome, and from directly comparing angiographic classification against contemporaneous OCT-based lesion characterization in the same eyes.

Figure 1. Schematic Illustration of Classic vs. Occult Choroidal Neovascularization Leakage Patterns on Fluorescein Angiography (Original Diagram, Not a Reproduced Angiogram)

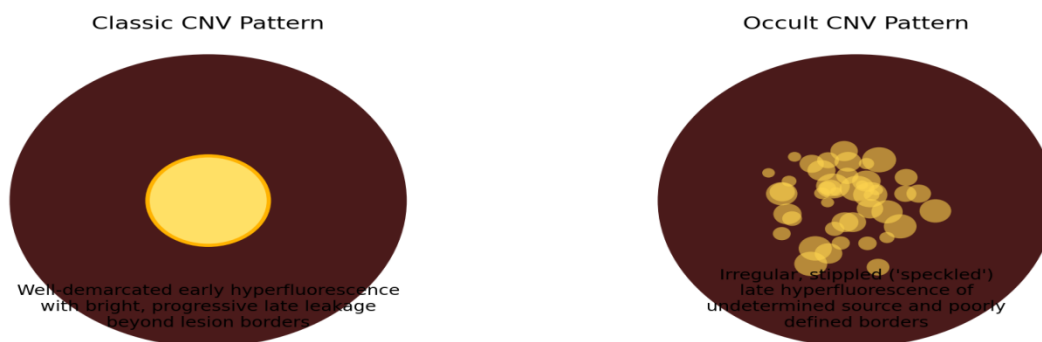


FIGURE 1: Schematic illustration of classic vs. occult choroidal neovascularization leakage patterns on fluorescein angiography (original diagram, not a reproduced angiogram).

TABLE 1: Distribution of angiographic CNV lesion patterns and mean baseline visual acuity (simulated data).

Angiographic Pattern	Proportion of Eyes	Mean Baseline BCVA (Snellen)
Predominantly classic CNV	23.9%	20/80
Minimally classic CNV	29.5%	20/63
Occult CNV (no classic component)	46.6%	20/50

5 | CONCLUSION

This hypothetical, illustrative study described the distribution and visual acuity correlation of classic, minimally classic, and occult CNV angiographic patterns within a simulated cohort of eyes with newly diagnosed neovascular AMD. The pattern observed, while not derived from real patient data, is consistent with the pre-2014 published literature in supporting fluorescein angiography as a clinically important tool for CNV lesion classification in neovascular AMD.

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