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Treatment Patterns for Myopic Choroidal Neovascularization in the United States

Analysis of the IRIS Registry

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Purpose: To characterize treatment patterns and outcomes in eyes with treatment-naïve myopic choroidal neovascularization (mCNV) in the United States.

Design: Retrospective cohort study.

Participants: Individuals aged 18 years and older seen in clinics participating in the American Academy of Ophthalmology's IRIS (Intelligent Research in Sight) Registry.

Methods: We analyzed data from the IRIS Registry, from January 1, 2012 to December 31, 2014, to identify cases of treatment-naïve mCNV, which was defined as the presence of myopic refractive error worse than −6.0 diopters with the presence of subretinal/choroidal neovascularization as indicated by International Classification of Diseases, Ninth Revision, Clinical Modification diagnosis of "362.16: Retinal Neovascularization NOS."

Main Outcome Measures: Type of initial treatment for mCNV was categorized as the administration of 1 of the following within the first 365 days after the diagnosis date: (1) observation (i.e., no treatment); (2) intravitreal anti-VEGF injection; (3) verteporfin photodynamic therapy (vPDT); or (4) laser photocoagulation. We assessed the difference between logarithm of the minimal angle of resolution (logMAR) visual acuity (VA) on the diagnosis date (baseline) and 1 year after the diagnosis date. Anti-VEGF injection frequency per treated eye over a 1-year period was also estimated.

Results: We identified 185 patients with treatment-naïve mCNV in 1 or both eyes. Treatment within 1 year of diagnosis was recorded for 73.0% (135/185); the remainder was classified as "observation." Nearly all treatment (134/135; 99.3%) consisted of anti-VEGF injections; 0.7% (1/135) received vPDT. Those treated with anti-VEGF injections showed significant improvement in VA at 1 year (mean logMAR VA improvement of 0.17 units, 95% confidence interval [CI], 0.12−0.20, $P < 0.01$), whereas those who were not treated showed a significant decline in VA at 1 year (mean logMAR VA decline: 0.03 units, 95% CI, 0.008−0.05, $P < 0.01$). The mean number of anti-VEGF injections for an eye with mCNV during the first year after diagnosis was 2.8 (standard deviation, 2.5) (median, 2.0; interquartile range, 1.0−4.0).

Conclusions: In the United States, anti-VEGF injection was the most frequently utilized treatment for mCNV. Those treated were observed to gain vision. However, one quarter of patients received no treatment and lost vision. Further studies are needed to understand the sociodemographic and health-systems barriers surrounding the delivery of anti-VEGF injections to patients with mCNV. *Ophthalmology 2017;■:1−9 © 2017 by the American Academy of Ophthalmology*

Myopic choroidal neovascularization (mCNV) is a rare, vision-threatening complication of myopia. Patients who develop mCNV can present with an acute deterioration of central visual acuity (VA) and have a high risk of long-term vision loss if they are not promptly treated.[1−7] Though there are many theories behind the pathogenesis of mCNV, the typical course is progressive and excessive elongation of the anterior−posterior axis of the globe that causes mechanical stress on the retina, resulting in breaks in the Bruch membrane and the formation of abnormal vessels in the subretinal space.[1,4]

To date, the treatment options for mCNV in the United States (U.S.) include intravitreal anti-VEGF injections (i.e., bevacizumab/ranibizumab/aflibercept), verteporfin photodynamic therapy (vPDT), and laser photocoagulation.[8] In the U.S., ranibizumab was approved in January 2017 for the treatment of mCNV; outside of the U.S., ranibizumab and aflibercept are approved in certain countries.[9−11] Additionally, in the U.S., vPDT is approved for the treatment of subfoveal mCNV. Although studies report the benefits of these therapies for mCNV, there are few national-level data on the treatment patterns and outcomes for mCNV in the U.S.[12−15] Specifically, there are limited data on the type and promptness of treatment that ophthalmologists offer to their patients with mCNV. Furthermore, for patients treated with anti-VEGF injections, few data exist on injection frequency and visual outcomes. To address these knowledge gaps, we used the American

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Academy of Ophthalmology's IRIS (Intelligent Research in Sight) Registry, the nation's first comprehensive eye disease clinical registry, to characterize treatment patterns and outcomes for mCNV in the U.S. The primary aims of this study were to assess the initial treatment offered to treatment-naïve mCNV patients and related visual outcomes; to estimate the timing of anti-VEGF administration in treatment-naïve mCNV patients; and to evaluate the burden of anti-VEGF injections and office visits experienced by treatment-naïve mCNV patients. The secondary aim of this study was to assess factors associated with the above management patterns for treatment-naïve mCNV patients.

Methods

Study Population

To identify individuals with myopic CNV in the U.S., we used data from the American Academy of Ophthalmology's IRIS Registry, the nation's first comprehensive eye disease clinical registry. The IRIS Registry is a centralized data repository that collects data on real-world practice patterns via electronic health records from ophthalmology practices across the U.S. Sociodemographic data (age, sex, race, geographic location of residence) were collected on individuals 18 years of age and older. Additionally, we obtained data on the patient's refraction (right eye) and presenting VA (Snellen format). Data were collected during the period from January 1, 2012 to December 31, 2014. In the sample of practices analyzed for this study, there was no identification at the patient level to determine whether the same patient was seen in different practices during the same time period. However, based on the recorded age, sex, and other sociodemographic characteristics of individuals in our study sample, no individual had the same characteristics, making it unlikely that we analyzed the same patient multiple times in our study.

Ethics

Data from the IRIS Registry are de-identified and do not require patient-level consent. Participating providers in the IRIS Registry reported their encounters on every patient seen in their practices. All diagnoses attached to a patient in the electronic health records represent a legal medical record and represent real-world diagnostic patterns.

Evaluation of Treatment-Naïve Myopic Choroidal Neovascularization Patients

As previously described, patients were defined as having mCNV if they had a high myopic refraction (myopia worse than or equal to −6 diopters in spherical equivalence, right eye) and an International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) code of "Retinal Neovascularization NOS" (ICD-9-CM 362.16), which reflects the presence of subretinal or choroidal neovascularization that did not have sufficient evidence to be associated with other specific retinal diagnoses (i.e., exudative age-related macular degeneration).[5] To ensure that our study population had underlying pathologic myopia, we only included those who had at least 1 of the ICD-9-CM diagnoses indicating "Progressive High (Degenerative) Myopia" (ICD-9-CM 360.21) at any point during their ophthalmic care. The first recorded date of the ICD-9-CM code of "Retinal Neovascularization NOS" during the study period of January 1, 2012, to December 31, 2014, was defined as the index date.

To ensure that the selected patients were treatment-naïve, newly diagnosed mCNV patients, we selected individuals who had at least 365 days of eligibility before the index date with no recorded mCNV diagnosis or procedural treatment for a choroidal neovascular membrane (i.e., CPT 67221/67225/67220/67028, representing focal laser, anti-VEGF, or PDT) before the index date. Individuals ever noted to have any other retinal condition possibly requiring anti-VEGF treatment, such as exudative age-related macular degeneration, diabetic macular edema, or retinal vein occlusion, were also excluded. Thereafter, we only included patients who had at least 365 days of follow-up data after the index date to ascertain treatment patterns for at least a full year after the index date. Analyses were conducted on individuals with complete VA data.

Evaluation of Initial Myopic Choroidal Neovascularization Treatment

The type of initial treatment for mCNV was defined as the administration of 1 of the following within the first 365 days of the index date: (1) observation (i.e., no treatment); (2) intravitreal anti-VEGF injection; (3) vPDT; or (4) laser photocoagulation. Intravitreal anti-VEGF (i.e., bevacizumab, ranibizumab, aflibercept, or pegaptanib) was identified through the CPT code 67028. Photodynamic therapy (PDT) was identified through the CPT code 67221 or 67225. Laser photocoagulation was identified through the CPT code 67220 or 0117T. When a patient did not receive anti-VEGF, PDT, or laser photocoagulation during the first year after the index date, we categorized these individuals as being observed. Combination treatment with the above therapies was also assessed. "Any treatment" was defined as the administration of intravitreal anti-VEGF, PDT, or laser photocoagulation.

Evaluation of Visual Acuity

VA was recorded in Snellen format. For analysis, we converted VA to logMAR units. VA for the affected eye on the index date was used as the baseline value. VA from the visit closest to 1 year after the index date (within 3 months) was used for the 1-year post−index date VA. No individuals had 1-year post−index date VA more than 15 months after the index date.

Evaluation of Timing of Initial Anti-VEGF Injection Administration

Among those receiving anti-VEGF injections, "delayed treatment" was defined as anti-VEGF injection that was given more than 1 month (i.e., >30 days) after the index date. "Prompt treatment" was defined as anti-VEGF injection that was given within a month (≤30 days) of the index date.

Evaluation of Number of Office Visits

Office visit frequency was assessed by evaluating the number of actual office records uploaded to the IRIS Registry. When individuals with treatment-naïve mCNV were seen at the index date and not subsequently seen for at least 365 days, they were classified as having "limited follow-up." In analyses, we compared the characteristics of those with only 1 visit (i.e., "limited follow-up") relative to those who had 2 or more visits during the first 365 days after the index date. To assess the proportion of mCNV patients that were closely followed by retina specialists, we estimated the proportion of patients being seen on a monthly (i.e., 4 weeks ±7 days) basis for 3, 6, and 12 consecutive months.