Medical Policy

Title: Scanning Computerized Ophthalmic Diagnostic Imaging Devices

Professional
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Current Effective Date: April 15, 2019

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### DESCRIPTION
Several techniques have been developed to measure the thickness of the optic nerve/retinal nerve fiber layer (RNFL) as a method to diagnose and monitor glaucoma. Measurement of ocular blood flow is also being evaluated as a diagnostic and management tool for glaucoma.

### OBJECTIVE
The objective of this policy is to assess whether methods that evaluate the optic nerve and nerve fiber layer or that evaluate retinal blood flow improve the net health outcome in individuals with glaucoma or who are suspected to have glaucoma.

### BACKGROUND
**Glaucoma**
Glaucoma is a disease characterized by degeneration of the optic nerve (optic disc). Elevated intraocular pressure (IOP) has long been thought to be the primary etiology, but the relationship between IOP and optic nerve damage varies among patients, suggesting a multifactorial origin. For example, some patients with clearly elevated IOP will show no optic nerve damage, while others with marginal or no pressure elevation will, nonetheless, show optic nerve damage. The association between glaucoma and other vascular disorders such as diabetes or hypertension suggests vascular factors may play a role in glaucoma. Specifically, it has been hypothesized that reductions in blood flow to the optic nerve may contribute to the visual field defects associated with glaucoma.

**Diagnosis and Management**
A comprehensive ophthalmologic exam is required for the diagnosis of glaucoma, but no single test is adequate for establishing the diagnosis. A comprehensive ophthalmologic examination includes an examination of the optic nerve by fundoscopy, evaluation of visual fields, and measurement of ocular pressure. The presence of
characteristic changes in the optic nerve or abnormalities in visual field, together with increased IOP, is sufficient for a definitive diagnosis. However, some patients will show ophthalmologic evidence of glaucoma with normal IOPs. These cases of normal tension glaucoma (NTG) are considered to be a type of primary open-angle glaucoma (POAG). Angle-closure glaucoma is another type of glaucoma associated with an increase in IOP. The increased IOP in angle-closure glaucoma arises from a reduction in aqueous outflow from the eye due to a closed angle in the anterior chamber.

Conventional management of the patient with glaucoma principally involves drug therapy, to control elevated IOPs, and serial evaluation of the optic nerve to follow disease progression. Standard methods of evaluation include careful direct examination of the optic nerve using ophthalmoscopy or stereophotography, or evaluation of visual fields. There is interest in developing more objective, reproducible techniques both to document optic nerve damage and to detect early changes in the optic nerve and RNFL before the development of permanent visual field deficits. Specifically, evaluating changes in the thickness of the RNFL has been investigated as a technique to diagnose and monitor glaucoma. However, IOP reduction is not effective in decreasing disease progression in a significant number of patients, and in patients with NTG, there is never an increase in IOP. It has been proposed that vascular dysregulation is a significant cause of damage to the RNFL, and there is interest in measuring ocular blood flow as both a diagnostic and a management tool for glaucoma. Changes in blood flow to the retina and choroid may be particularly relevant for diagnosis and treatment of NTG. A variety of techniques have been developed, as described below.

Techniques to Evaluate the Optic Nerve and RNFL

Confocal Scanning Laser Ophthalmoscopy
Confocal scanning laser ophthalmoscopy (CSLO) is an image acquisition technique intended to improve the quality of the examination compared with standard ophthalmologic examination. A laser is scanned across the retina along with a detector system. Only a single spot on the retina is illuminated at any time, resulting in a high-contrast image of great reproducibility that can be used to estimate the thickness of the RNFL. In addition, this technique does not require maximal mydriasis, which may be a problem in patients with glaucoma. The Heidelberg Retinal Tomography is a commonly used technology.

Scanning Laser Polarimetry
The RNFL is birefringent, causing a change in the state of polarization of a laser beam as it passes. A 780-nm diode laser is used to illuminate the optic nerve. The polarization state of the light emerging from the eye is then evaluated and correlated with RNFL thickness. Unlike CSLO, SLP can directly measure the thickness of the RNFL. GDx is a common example of an SLP. GDx contains a normative database and statistical software package to allow comparison with age-matched normal subjects of the same ethnic origin. The advantages of this system are that images can be obtained without pupil dilation, and evaluation can be done in approximately 10 minutes. Current
instruments have added enhanced and variable corneal compensation technology to account for corneal polarization.

**Optical Coherence Tomography**
Optical coherence tomography (OCT) uses near-infrared light to provide direct cross-sectional measurement of the RNFL. The principles employed are similar to those used in B-mode ultrasound except light, not sound, is used to produce the 2-dimensional images. The light source can be directed into the eye through a conventional slit-lamp biomicroscope and focused onto the retina through a typical 78-diopter lens. This system requires dilation of the patient’s pupil. OCT is an example of this technology. OCT analysis software is being developed to include optic nerve head parameters with spectral domain OCT, analysis of macular parameters, and hemodynamic parameters with Doppler OCT and OCT angiography.

**Pulsatile Ocular Blood Flow**
The pulsatile variation in ocular pressure results from the flow of blood into the eye during cardiac systole. Pulsatile ocular blood flow can thus be detected by the continuous monitoring of IOP. The detected pressure pulse can then be converted into a volume measurement using the known relationship between ocular pressure and ocular volume. Pulsatile blood flow is primarily determined by the choroidal vessels, particularly relevant to patients with glaucoma, because the optic nerve is supplied in large part by choroidal circulation.

**Techniques to Measure Ocular Blood Flow**
A number of techniques have been developed to assess ocular blood flow. They include laser speckle flowgraphy, color Doppler imaging, Doppler Fourier domain OCT, laser Doppler velocimetry, confocal scanning laser Doppler flowmetry, and retinal functional imaging.\(^1\)

**Laser Speckle Flowgraphy**
Laser speckle is detected when a coherent light source such as laser light is dispersed from a diffusing surface such as retinal and choroidal vessels and the circulation of the optic nerve head. The varying patterns of light can be used to determine red blood cell velocity and retinal blood flow. However, due to differences in the tissue structure in different eyes, flux values cannot be used for comparisons between eyes. This limitation may be overcome by subtracting background choroidal blood flow results from the overall blood flow results in the region of interest.

**Color Doppler**
Color Doppler imaging has also been investigated as a technique to measure the blood velocity in the retinal and choroidal arteries. This technique delivers ultrasound in pulsed Doppler mode with a transducer set on closed eyelids. The examination takes 30 to 40 minutes, and is most effective for the mean velocity of large ophthalmic vessels such as the ophthalmic artery, the central retinal artery, and the short posterior ciliary
arteries. However, total blood flow cannot be determined with this technique, and imaging is highly dependent on probe placement.

**Doppler Fourier Domain OCT:** Doppler Fourier domain OCT is a noncontact imaging technique that detects the intensity of the light scattered back from erythrocytes as they move in the vessels of the ocular tissue. This induces a frequency shift that represents the velocity of the blood in the ocular tissue.

**Laser Doppler Velocimetry:** Laser Doppler velocimetry compares the frequency of reflected laser light from a moving particle to stationary tissue.

**Confocal Scanning Laser Doppler Flowmetry:** Confocal scanning laser Doppler flowmetry combines laser Doppler flowmetry with confocal scanning laser tomography. Infrared laser light is used to scan the retina, and the frequency and amplitude of Doppler shifts are determined from the reflected light. Determinations of blood velocity and blood volume are used to compute the total blood flow and create a physical map of retinal flow values.

**REGULATORY STATUS**

A number of confocal scanning laser ophthalmoscopy, scanning laser polarimetry, and optical coherence tomography (OCT) devices have been cleared by the U.S. Food and Drug Administration (FDA) through the 510(k) process for imaging the posterior eye segment. For example, the RTVue XR OCT Avanti™ (Optovue) is an OCT system indicated for the in vivo imaging and measurement of the retina, retinal nerve fiber layer, and optic disc as a tool and aid in the diagnosis and management of retinal diseases by a clinician. The RTVue XR OCT Avanti™ with Normative Database is a quantitative tool for the comparison of retina, retinal nerve fiber layer, and optic disk measurements in the human eye to a database of known normal subjects. It is intended for use as a diagnostic device to aid in the detection and management of ocular diseases. In 2016, the RTVue XR OCT with Avanti™ with AngioVue™ Software was cleared by FDA through the 510(k) process (K153080) as an aid in the visualization of vascular structures of the retina and choroid. FDA product code: HLI, OBO.

In 2012, the iExaminer™ (Welch Allyn) received marketing clearance by FDA through the 510(k) process. The iExaminer consists of a hardware adapter and associated software (iPhone® App) to capture, store, send and retrieve images from the Welch Allyn PanOptic™ Ophthalmoscope using an iPhone®. FDA product code: HKI.
POLICY
A. Scanning Laser Ophthalmoscopy (SLO) test is allowable for the diagnosis and the monitoring of the optic nerve, retinal conditions and glaucoma. Testing may be allowed every year. If the testing is done more frequently than every year, consultant review will be required.

B. Optical Coherence Tomography (OCT) test is allowed for the diagnoses, listed below, monitoring for retinal conditions, and ocular toxicity secondary to high-risk medications (ie, chloroquine [Aralen], hydroxychloroquine [Plaquinil], Interferon alpha-2b, Amiodarone, tamoxifen citrate [Nolvadex], fingolimod [Gilenya], Seroquel).

Repeat testing:
1. If Exudative Age-Related Macular Degeneration (AMD):
   Repeat OCT will significantly help guide the need for retreatment (with photodynamic therapy [PDT] or intravitreal injection treatments) in conjunction with intravenous fluorescein angiography (IVF) / indocyanine green (ICG). Maximum of 8 per year linked to intravitreal injections.

2. If Macular Drusen:
   Repeat annually, only if subjective visual changes or suspicion of choroidal neovascularization: if more than 2 studies per year, then documentation is required.

3. If Diabetic Macular Edema (DME):
   Maximum of 8 per year linked to intravitreal injections or laser treatment.

4. If Retinal Detachment (RD):
   Repeat pre-treatment and post-surgical at 2 months (maximum of 2).

5. If Epiretinal Membrane (ERM):
   Repeat pre-treatment and post-surgical (maximum of 4 per year) if with macular edema.

6. If Macular Hole:
   Repeat pre-treatment and post-treatment (maximum of 4 per year) in cases of partially closed hole.

7. If Cystoid Macular Edema:
   Repeat every 2 months during acute treatment.

8. If Branch Retinal Vein Occlusion (BRVO):
   Maximum of 8 per year linked to intravitreal injections.
9. If Central Retinal Vein Occlusion (CRVO):
   Maximum of 8 per year linked to intravitreal injections.

10. If Vitreomacular Traction / Adhesion:
    Maximum of 4 per year.

C. OCT is also allowed for diagnosing and monitoring glaucoma, nerve fiber layer,
    and optic nerve conditions. Testing may be allowed every year. If the testing is
done more frequently than every year, consultant review will be required.

RATIONAL
This policy has been updated regularly with searches of the MEDLINE database. The most
recent literature update was performed through January 8, 2018.

Evidence reviews assess whether a medical test is clinically useful. A useful test provides
information to make a clinical management decision that improves the net health outcome.
That is, the balance of benefits and harms is better when the test is used to manage the
condition than when another test or no test is used to manage the condition.

The first step in assessing a medical test is to formulate the clinical context and purpose of the
test. The test must be technically reliable, clinically valid, and clinically useful for that purpose.
Evidence reviews assess the evidence on whether a test is clinically valid and clinically useful.
Technical reliability is outside the scope of these reviews, and credible information on technical
reliability is available from other sources.

The use of various techniques of retinal nerve fiber layer (RNFL) analysis (confocal scanning
laser ophthalmoscopy [CSLO], scanning laser polarimetry [SLP], optical coherence tomography
[OCT]) for the diagnosis and management of glaucoma was addressed by 2 TEC Assessments

Imaging of the Optic Nerve and RNFL
Clinical Context and Test Purpose
The diagnosis and monitoring of optic nerve damage are essential for evaluating the
progression of glaucoma and determining appropriate treatment.

The question addressed in this evidence review is: Do imaging techniques for the optic nerve
and RNFL improve diagnosis and monitoring of glaucoma?

The following PICOTS were used to select literature to inform this review.

Patients
The relevant populations are patients with glaucoma or who are suspected to have glaucoma
and are being evaluated for diagnosis and monitoring of glaucoma progression.
Interventions
The tests being considered for assessment of the optic nerve and RNFL include CLSO, SLP, and OCT. These tests are considered add-on to the standard clinical evaluation.

Comparators
There is no single criterion standard for the diagnosis of glaucoma. This diagnosis is made from a combination of visual field testing, intraocular pressure (IOP) measurement, and optic nerve and RNFL assessment by an ophthalmologist.

Outcomes
Relevant outcomes include the clarity of the images and how reliable the test is at evaluating the optic nerve and nerve fiber layer changes. Demonstration that the information can be used to improve patient outcomes is essential for determining the utility of an imaging technology. Although direct evidence on the impact of the imaging technology from controlled trials would be preferred, in most cases, a chain of evidence needs to be constructed to determine whether there is a tight linkage between the technology and improved health outcomes. The outcomes relevant to this evidence review are IOP, loss of vision, and changes in IOP-lowering medications used to treat glaucoma.

Timing
For patients with manifest glaucoma, the relevant period of follow-up is the immediate diagnosis of glaucoma. For patients with suspected glaucoma, longer term follow-up would be needed to detect changes in visual field or RNFL. Clinical utility might be demonstrated by a change in the management and reduction in glaucoma progression across follow-up.

Setting
Patients may be self-referred, referred by optometrists, or referred by a general ophthalmologist to a glaucoma specialist. These procedures can be performed in an ophthalmologist’s office.

Simplifying Test Terms
There are 3 core characteristics for assessing a medical test. Whether imaging, laboratory, or other, all medical tests must be:

- Technically reliable
- Clinically valid
- Clinically useful

Because different specialties may use different terms for the same concept, we are highlighting the core characteristics. The core characteristics also apply to different uses of tests, such as diagnosis, prognosis, and monitoring treatment.

Diagnostic tests detect presence or absence of a condition. Surveillance and treatment monitoring are essentially diagnostic tests over a time frame. Surveillance to see whether a condition develops or progresses is a type of detection. Treatment monitoring is also a type of detection because the purpose is to see if treatment is associated with the disappearance, regression, or progression of the condition.
Prognostic tests predict the risk of developing a condition in the future. Tests to predict response to therapy are also prognostic. Response to therapy is a type of condition and can be either a beneficial response or adverse response. The term predictive test is often used to refer to response to therapy. To simplify terms, we use prognostic to refer both to predicting a future condition or to predicting a response to therapy.

Technically Reliable
Assessment of technical reliability focuses on specific tests and operators and requires review of unpublished and often proprietary information. Review of specific tests, operators, and unpublished data are outside the scope of this evidence review and alternative sources exist. This evidence review focuses on the clinical validity and clinical utility.

Clinically Valid
A test must detect the presence or absence of a condition, the risk of developing a condition in the future, or treatment response (beneficial or adverse).

In 2012, the Agency for Healthcare Research and Quality published a comparative effectiveness review of screening for glaucoma.4 Included were randomized controlled trials (RCTs), quasi-RCTs, observational cohort and case-control studies, and case series with more than 100 participants. The interventions evaluated included ophthalmoscopy, fundus photography or computerized imaging (OCT, retinal tomography, SLP), pachymetry (corneal thickness measurement), perimetry, and tonometry. No evidence was identified that addressed whether an open-angle glaucoma screening program led to a reduction in IOP, less visual impairment, reduction in visual field loss or optic nerve damage, or improvement in patient-reported outcomes. No evidence was identified on harms of a screening program. Over 100 studies were identified on the diagnostic accuracy of screening tests. However, due to the lack of a definitive diagnostic reference standard and heterogeneity in study designs, synthesis of results could not be completed.

A Cochrane review (2015) assessed the diagnostic accuracy of optic nerve head and RNFL imaging for glaucoma.5 Included were 103 case-control studies and 3 cohort studies (total N=16,260 eyes) that evaluated the accuracy of recent commercial versions of OCT (spectral domain), Heidelberg Retinal Tomograph (HRT) III, or SLP (GDx VCC or ECC) for diagnosing glaucoma. The population was patients referred for suspected glaucoma, typically due to an elevated IOP, abnormal optic disc appearance, and/or an abnormal visual field identified in primary eye care. Population-based screening studies were excluded. Most comparisons examined different parameters within the 3 tests, and the parameters with the highest diagnostic odds ratio were compared. The 3 tests (OCT, HRT, SLP) had similar diagnostic accuracy. Specificity was close to 95%, while sensitivity was 70%. Because a case-control design with healthy participants and glaucoma patients was used in nearly all studies, concerns were raised about the potential for bias, overestimation of accuracy, and applicability of the findings to clinical practice.

Clinically Useful
A test is clinically useful if the use of the results informs management decisions that improve the net health outcome of care. The net health outcome can be improved if patients receive correct therapy, or more effective therapy, or avoid unnecessary therapy, or avoid unnecessary testing.
Direct Evidence

Direct evidence of clinical utility is provided by studies that have compared health outcomes for patients managed with and without the test. Because these are intervention studies, the preferred evidence would be from randomized controlled trials.

A technology assessment, conducted by Lin et al (2007) for the American Academy of Ophthalmology, reviewed 159 studies, published between 2003 and 2006, evaluating optic nerve head and RNFL devices used to diagnose or detect glaucoma progression. The assessment concluded: “The information obtained from imaging devices is useful in clinical practice when analyzed in conjunction with other relevant parameters that define glaucoma diagnosis and progression.” Management changes for patients diagnosed with glaucoma may include the use of IOP-lowering medications, monitoring for glaucoma progression, and potentially surgery to slow the progression of glaucoma.

Section Summary: Imaging of the Optic Nerve and RNFL

Numerous studies and systematic reviews have described findings from patients with glaucoma using CSLO, SLP, and OCT. Although the specificity in these studies was high, it is likely that accuracy was overestimated due to the case-control designs used in the studies. The literature and specialty society guidelines have indicated that optic nerve analysis using CSLO, SLP, and OCT are established add-on tests that can be used with other established tests to improve the diagnosis and direct management of patients with glaucoma and those who are glaucoma suspects. Management changes for patients diagnosed with glaucoma may include the use of IOP-lowering medications, monitoring for glaucoma progression, and potentially surgery.

Evaluation of Ocular Blood Flow

Clinical Context and Test Purpose

The diagnosis and monitoring of optic nerve damage are essential for evaluating the progression of glaucoma and determining appropriate treatment. Measurement of ocular blood flow has been studied as a technique to evaluate patients with glaucoma or suspected glaucoma.

The question addressed in this evidence review is: Do various techniques (eg, color Doppler imaging [CDI], Doppler Fourier domain OCT, laser Doppler velocimetry, confocal scanning laser Doppler flowmetry, retinal functional imager) for assessing ocular blood flow improve diagnosis and monitoring of glaucoma? One potential application is the early detection of normal tension glaucoma (NTG).

The following PICOTS were used to select literature to inform this review.

Patients

The relevant patient populations are patients with glaucoma or suspected glaucoma and are being evaluated for diagnosis and monitoring of glaucoma progression. These tests may have particular utility for NTG.

Interventions

The tests being considered for assessment of the optic nerve and optic nerve layer include CDI, Doppler Fourier domain OCT, laser Doppler velocimetry, confocal scanning laser Doppler flowmetry, and retinal functional imager.
**Comparators**
There is no criterion standard for the diagnosis of glaucoma. The diagnosis of glaucoma is made using a combination of visual field testing, IOP measurements, and optic nerve and RNFL assessment.

**Outcomes**
Relevant outcomes include the reliability of the test for evaluating ocular blood flow and the association between ocular blood flow parameters and glaucoma progression. Demonstration that the information can be used to improve patient outcomes is essential to determining the utility of a diagnostic technology. Although direct evidence on the impact of the imaging technology from controlled trials would be preferred, in most cases, a chain of evidence is needed to determine whether there is a tight linkage between the technology and improved health outcomes. The outcomes relevant to this evidence review are IOP, loss of vision, and changes in IOP-lowering medications used to treat glaucoma.

**Timing**
For patients with manifest glaucoma, the relevant period of follow-up is the immediate diagnosis of glaucoma. For patients with suspected glaucoma, longer term follow-up would be needed to detect changes in IOP and loss of vision. Clinical utility might be demonstrated by a change in the management and reduction in glaucoma progression across follow-up.

**Setting**
Many of these procedures are performed with specialized equipment. While reports of use are longstanding (eg, Bafa et al [2001]), investigators have commented on the complexity of these parameters and have noted that many of these technologies are not commonly used in clinical settings.

**Technically Reliable**
Assessment of technical reliability focuses on specific tests and operators and requires review of unpublished and often proprietary information. Review of specific tests, operators, and unpublished data are outside the scope of this evidence review and alternative sources exist. This evidence review focuses on the clinical validity and clinical utility.

**Clinically Valid**
A test must detect the presence or absence of a condition, the risk of developing a condition in the future, or treatment response (beneficial or adverse).

Abegao Pinto et al (2016) reported on the results from the prospective, cross-sectional, case-control, Leuven Eye Study, which included 614 individuals who had primary open-angle glaucoma (n=214), NTG (n=192), ocular hypertension (n=27), suspected glaucoma (n=41), or healthy controls (n=140). The study objective was to identify the blood flow parameters most highly associated with glaucoma using technology commonly available in an ophthalmologist’s office or hospital radiology department. Assessment of ocular blood flow included CDI, retinal oximetry, dynamic contour tonometry, and OCT enhanced-depth imaging of the choroid. The glaucoma groups had higher perfusion pressure than controls (p<0.001), with lower velocities in both central retinal vessels (p<0.05), and choroidal thickness asymmetries. The NTG group, but not the primary open-angle glaucoma group, had higher retinal venous saturation than
healthy controls (p=0.005). There were no significant differences in macular scans. The
diagnostic accuracy and clinical utility were not addressed.

Kurysheva et al (2017) compared ocular blood flow with choroidal thickness to determine which
had a higher diagnostic value for detecting early glaucoma.\textsuperscript{12} Thirty-two patients with pre-
perimetric glaucoma were matched with 30 control patients. Using OCT, RNFL thickness
between groups was found to be comparable; the ganglion cell complex was thicker in the
control patients, and there was no significant difference between groups for choroid foveal loss
volume. Mean blood flow velocity in the vortex veins had the highest area under the receiver
operating characteristic curve ROC (1.0) and \textit{z}-value (5.35). Diastolic blood flow velocity in the
central retinal artery had a diagnostic value of 2.74 and area under the receiver operating
characteristic curve of 0.73. The authors concluded that this study suggested a diagnostic
benefit in measuring blood flow velocities.

individuals.\textsuperscript{13} In this prospective study, the authors specifically looked at mean blur rate blood
flow in the optic nerve head and a peripapillary region. First, participants' blood flow was
measured when they were in a sitting position; then, participants were asked to perform an
isometric “squatting” exercise for 6 minutes. Compared with baseline (sitting), exercise
significantly increased ocular perfusion blood pressure (78.5%), mean blur rate in the tissue of
the optic nerve head (18.1%), and mean blur rate in the peripapillary region (21.18.3%)
(p<0.001). Few studies have used laser speckle flowgraphy to study autoregulation of ocular
blood flow during a change in blood pressure, and this study is limited to Japanese populations.
Despite the lack of literature and limited population, the authors noted laser speckle flowgraphy
could be a valuable tool to study the regulation of blood flow in the optic nerve head,
particularly in patients suspected of having glaucoma or patients who have glaucoma.

Rusia et al (2011) reported on use of CDI in normal and glaucomatous eyes.\textsuperscript{14} Using data from
other studies, a weighted mean was derived for the peak systolic velocity, end-diastolic velocity,
and Pourcelot Resistive Index in the ophthalmic, central retinal, and posterior ciliary arteries.
Data from 3061 glaucoma patients and 1072 controls were included. Mean values for
glaucomatous eyes were within 1 standard deviation of the values for controls for most CDI
parameters. Methodologic differences created interstudy variance in CDI values, complicating
the construction of a normative database and limiting its utility. The authors noted that because
the mean values for glaucomatous and normal eyes had overlapping ranges, caution should be
used when classifying glaucoma status based on a single CDI measurement.

**Clinically Useful**
A test is clinically useful if the use of the results informs management decisions that improve
the net health outcome of care. The net health outcome can be improved if patients receive
correct therapy, or more effective therapy, or avoid unnecessary therapy, or avoid unnecessary
testing.

**Direct Evidence**
Direct evidence of clinical utility is provided by studies that have compared health outcomes for
patients managed with and without the test. Because these are intervention studies, the
preferred evidence would be from randomized controlled trials.
The clinical utility of techniques to evaluate ocular blood flow is similar to that for other imaging techniques. The objective is to improve the diagnosis and direct management of patients with glaucoma or suspected glaucoma. Measures of ocular blood flow may have particular utility for the diagnosis and monitoring of NTG.

The only longitudinal study identified is a study by Calvo et al (2012) on the predictive value of retrobulbar blood flow velocities in a prospective series of 262 who were glaucoma suspect. At baseline, all participants had normal visual field, increased IOP (mean, 23.56 mm Hg), and glaucomatous optic disc appearance. Blood flow velocities were measured by CDI during the baseline examination, and conversion to glaucoma was assessed at least yearly according to changes observed with CSLO. During the 48-month follow-up, 36 (13.7%) patients developed glaucoma and 226 did not. Twenty (55.5%) of those who developed glaucoma also showed visual field worsening (moderate agreement, κ=0.38). Mean end-diastolic and mean velocity in the ophthalmic artery were significantly reduced at baseline in subjects who developed glaucoma compared with subjects who did not.

**Chain of Evidence**
Indirect evidence on clinical utility rests on clinical validity. If the evidence is insufficient to demonstrate test performance, no inferences can be made about clinical utility.

The evidence does not permit any inferences about the utility of ocular blood flow evaluation in the evaluation of glaucoma.

**Section Summary: Evaluation of Ocular Blood Flow**
Techniques to measure ocular blood flow or ocular blood velocity are being evaluated for the diagnosis of glaucoma. Data for these techniques remain limited. Current literature focuses on which technologies are most reliably associated with glaucoma. Literature reviews have not identified studies that suggest whether these technologies improve the diagnosis of glaucoma or whether measuring ocular blood flow in patients with glaucoma or suspected glaucoma improves health outcomes.

**SUMMARY OF EVIDENCE**
For individuals who have glaucoma or suspected glaucoma who receive imaging of the optic nerve and retinal nerve fiber layer, the evidence includes studies on diagnostic accuracy. Relevant outcomes are test accuracy, symptoms, morbid events, functional outcomes, and medication use. Confocal scanning laser ophthalmoscopy (CSLO), scanning laser polarimetry (SLP), and optical coherence tomography (OCT) can be used to evaluate the optic nerve and retinal nerve fiber layer in patients with glaucoma and suspected glaucoma. Numerous articles have described findings from patients with known and suspected glaucoma using CSLO, SLP, and OCT. These studies have reported that abnormalities may be detected on these examinations before functional changes are noted. The literature and specialty society guidelines have indicated that optic nerve analysis using CSLO, SLP, and OCT are established add-on tests that may be used to diagnose and manage patients with glaucoma and suspected glaucoma. These results are often considered along with other findings to make diagnostic and therapeutic decisions about glaucoma care, including use of topical medication, monitoring, and surgery to lower intraocular pressure. Thus, accurate diagnosis of glaucoma would be expected to reduce the progression of glaucoma.
For individuals who have glaucoma or suspected glaucoma who receive evaluation of ocular blood flow, the evidence includes association studies. Relevant outcomes are test accuracy, symptoms, morbid events, functional outcomes, and medication use. Techniques to measure ocular blood flow or ocular blood velocity are used to determine appropriate glaucoma treatment options. The data for these techniques remain limited. Literature reviews have not identified studies on the technical performance of these tests (eg, test-retest reliability), whether these technologies improve diagnostic accuracy, or whether they improve health outcomes in patients with glaucoma. Some have suggested that these parameters may inform understanding of the variability in visual field changes in patients with glaucoma, ie, they may help explain why patients with similar levels of intraocular pressure develop markedly different visual impairments. However, data on use of ocular blood flow, pulsatile ocular blood flow, and/or blood flow velocity are currently lacking.

**CLINICAL INPUT FROM PHYSICIAN SPECIALTY SOCIETIES AND ACADEMIC MEDICAL CENTERS**

While the various physician specialty societies and academic medical centers may collaborate with and make recommendations during this process, through the provision of appropriate reviewers, input received does not represent an endorsement or position statement by the physician specialty societies or academic medical centers, unless otherwise noted.

In response to requests, input was received from 1 physician specialty society and 3 academic medical centers while this policy was under review in 2009. Most reviewers supported use of these techniques (confocal scanning laser ophthalmoscopy, scanning laser polarimetry, optical coherence tomography) in the care of patients with glaucoma and those with suspected glaucoma suspect. Reviewers provided data to demonstrate that this testing is equivalent to expert assessment of optic disc photography for both detecting glaucoma and showing disease progression. Reviewers also commented on favorable aspects of this testing. For example, unlike other glaucoma testing, these tests can be done more easily (eg, testing does not always need to be done with dilated pupils) and ambient light level may be (is) less critical. In addition, while serial stereophotographs of the optic nerves are considered by many as the criterion standard, they are not always practical, especially for general ophthalmologists. This testing also requires less cooperation from the patient, which can help when evaluating some older patients.

**PRACTICE GUIDELINES AND POSITION STATEMENTS**

American Academy of Ophthalmology
The American Academy of Ophthalmology’s (AAO) 2015 primary open-angle glaucoma (POAG) suspect and POAG preferred practice patterns recommend evaluating the optic nerve and retinal nerve fiber layer. The documents state that “Although they are distinctly different methodologies, stereoscopic disc photographs and computerized images of the nerve are complementary with regard to the information they provide the clinician who must manage the patient.” The guidelines describe 3 types of computer-based imaging devices (CSLO, OCT, SLP) that are currently available for glaucoma, which are similar in their ability to distinguish glaucoma from controls and state that “computer-based digital imaging of the ONH and RNFL is routinely used to provide quantitative information to supplement the clinical examination of the optic nerve.... One rationale for using computerized imaging is to distinguish glaucomatous damage from eyes without glaucoma when thinning of the RNFL is measured, thereby facilitating earlier diagnosis and detection of optic nerve damage”. In addition, AAO concluded...
that, as device technology evolves the performance of diagnostic imaging devices is expected to improve.

**U.S. PREVENTIVE SERVICES TASK FORCE RECOMMENDATIONS**

Not applicable.

**ONGOING AND UNPUBLISHED CLINICAL TRIALS**

Some currently unpublished trials that might influence this review are listed in Table 1.

**Table 1. Summary of Key Trials**

<table>
<thead>
<tr>
<th>NCT No.</th>
<th>Trial Name</th>
<th>Planned Enrollment</th>
<th>Completion Date</th>
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<tr>
<td>Ongoing</td>
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<tr>
<td>NCT02178085</td>
<td>Ocular Blood-flow Assessment by Magnetic Resonance Angiography in Glaucoma</td>
<td>62</td>
<td>Sep 2018</td>
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<tr>
<td>NCT01957267</td>
<td>Longitudinal Observational Study Using Functional and Structural Optical Coherence Tomography to Diagnose and Guide Treatment of Glaucoma</td>
<td>150</td>
<td>Oct 2018</td>
</tr>
</tbody>
</table>

NCT: national clinical trial.

**CODING**

The following codes for treatment and procedures applicable to this policy are included below for informational purposes. Inclusion or exclusion of a procedure, diagnosis or device code(s) does not constitute or imply member coverage or provider reimbursement. Please refer to the member’s contract benefits in effect at the time of service to determine coverage or non-coverage of these services as it applies to an individual member.

**CPT/HCPCS**

- 92133 Scanning computerized ophthalmic diagnostic imaging, posterior segment, with interpretation and report, unilateral or bilateral; optic nerve
- 92134 Scanning computerized ophthalmic diagnostic imaging, posterior segment, with interpretation and report, unilateral or bilateral; retina
- 0198T Measurement of ocular blood flow by repetitive intraocular pressure sampling, with interpretation and report

**ICD-10 Diagnoses**

- A18.53 Tuberculous chorioretinitis
- B39.4 Histoplasmosis capsulati, unspecified
- B39.9 Histoplasmosis, unspecified
- C69.31 Malignant neoplasm of right choroid
- C69.32 Malignant neoplasm of left choroid
- D31.31 Benign neoplasm of right choroid
- D31.32 Benign neoplasm of left choroid
- E08.311 Diabetes mellitus due to underlying condition with unspecified diabetic retinopathy with macular edema
- E08.3211 Diabetes mellitus due to underlying condition with mild nonproliferative diabetic retinopathy with macular edema, right eye
E08.3212  Diabetes mellitus due to underlying condition with mild nonproliferative diabetic retinopathy with macular edema, left eye
E08.3213  Diabetes mellitus due to underlying condition with mild nonproliferative diabetic retinopathy with macular edema, bilateral
E08.3291  Diabetes mellitus due to underlying condition with mild nonproliferative diabetic retinopathy without macular edema, right eye
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E08.3533  Diabetes mellitus due to underlying condition with proliferative diabetic retinopathy with traction retinal detachment not involving the macula, bilateral
E08.3541  Diabetes mellitus due to underlying condition with proliferative diabetic retinopathy with combined traction retinal detachment and rhegmatogenous retinal detachment, right eye
E08.3542  Diabetes mellitus due to underlying condition with proliferative diabetic retinopathy with combined traction retinal detachment and rhegmatogenous retinal detachment, left eye
E08.3543  Diabetes mellitus due to underlying condition with proliferative diabetic retinopathy with combined traction retinal detachment and rhegmatogenous retinal detachment, bilateral
E08.3551  Diabetes mellitus due to underlying condition with stable proliferative diabetic retinopathy, right eye
E08.3552  Diabetes mellitus due to underlying condition with stable proliferative diabetic retinopathy, left eye
E08.3553  Diabetes mellitus due to underlying condition with stable proliferative diabetic retinopathy, bilateral
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E08.3592  Diabetes mellitus due to underlying condition with proliferative diabetic retinopathy without macular edema, left eye
E08.3593  Diabetes mellitus due to underlying condition with proliferative diabetic retinopathy without macular edema, bilateral
E08.37X1  Diabetes mellitus due to underlying condition with diabetic macular edema, resolved following treatment, right eye
E08.37X2  Diabetes mellitus due to underlying condition with diabetic macular edema, resolved following treatment, left eye
E08.37X3  Diabetes mellitus due to underlying condition with diabetic macular edema, resolved following treatment, bilateral
E09.311  Drug or chemical induced diabetes mellitus with unspecified diabetic retinopathy with macular edema
E09.3211  Drug or chemical induced diabetes mellitus with mild nonproliferative diabetic retinopathy with macular edema, right eye
E09.3212  Drug or chemical induced diabetes mellitus with mild nonproliferative diabetic retinopathy with macular edema, left eye
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E09.3533  Drug or chemical induced diabetes mellitus with proliferative diabetic retinopathy with traction retinal detachment not involving the macula, bilateral
E09.3534  Drug or chemical induced diabetes mellitus with stable proliferative diabetic retinopathy, bilateral
E09.3541  Drug or chemical induced diabetes mellitus with proliferative diabetic retinopathy with combined traction retinal detachment and rhegmatogenous retinal detachment, right eye
E09.3542  Drug or chemical induced diabetes mellitus with proliferative diabetic retinopathy with combined traction retinal detachment and rhegmatogenous retinal detachment, left eye
E09.3543 Drug or chemical induced diabetes mellitus with proliferative diabetic retinopathy with combined traction retinal detachment and rhegmatogenous retinal detachment, bilateral
E09.3551 Drug or chemical induced diabetes mellitus with stable proliferative diabetic retinopathy, right eye
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E10.3393 Type 1 diabetes mellitus with moderate nonproliferative diabetic retinopathy without macular edema, bilateral
E10.3411 Type 1 diabetes mellitus with severe nonproliferative diabetic retinopathy with macular edema, right eye

Contains Public Information
E10.3412  Type 1 diabetes mellitus with severe nonproliferative diabetic retinopathy with macular edema, left eye
E10.3413  Type 1 diabetes mellitus with severe nonproliferative diabetic retinopathy with macular edema, bilateral
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E13.311   Other specified diabetes mellitus with unspecified diabetic retinopathy with macular edema
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E13.3553 Other specified diabetes mellitus with stable proliferative diabetic retinopathy, bilateral
E13.3591 Other specified diabetes mellitus with proliferative diabetic retinopathy without macular edema, right eye
E13.3592 Other specified diabetes mellitus with proliferative diabetic retinopathy without macular edema, left eye
E13.3593 Other specified diabetes mellitus with proliferative diabetic retinopathy without macular edema, bilateral
E13.37X Other specified diabetes mellitus with diabetic macular edema, resolved following treatment, right eye
E13.37X Other specified diabetes mellitus with diabetic macular edema, resolved following treatment, left eye
E13.37X Other specified diabetes mellitus with diabetic macular edema, resolved following treatment, bilateral
H21.551 Recession of chamber angle, right eye
H21.552 Recession of chamber angle, left eye
H21.553 Recession of chamber angle, bilateral
H30.001 Unspecified focal chorioretinal inflammation, right eye
H30.002 Unspecified focal chorioretinal inflammation, left eye
H30.003 Unspecified focal chorioretinal inflammation, bilateral
H30.011 Focal chorioretinal inflammation, juxtapapillary, right eye
H30.012 Focal chorioretinal inflammation, juxtapapillary, left eye
H30.013 Focal chorioretinal inflammation, juxtapapillary, bilateral
H30.021 Focal chorioretinal inflammation of posterior pole, right eye
H30.022 Focal chorioretinal inflammation of posterior pole, left eye
H30.023 Focal chorioretinal inflammation of posterior pole, bilateral
H30.031 Focal chorioretinal inflammation, peripheral, right eye
H30.032 Focal chorioretinal inflammation, peripheral, left eye
H30.033 Focal chorioretinal inflammation, peripheral, bilateral
H30.041 Focal chorioretinal inflammation, macular or paramacular, right eye
H30.042 Focal chorioretinal inflammation, macular or paramacular, left eye
H30.043 Focal chorioretinal inflammation, macular or paramacular, bilateral
H30.101 Unspecified disseminated chorioretinal inflammation, right eye
H30.102 Unspecified disseminated chorioretinal inflammation, left eye
H30.103 Unspecified disseminated chorioretinal inflammation, bilateral
H30.111 Disseminated chorioretinal inflammation of posterior pole, right eye
H30.112 Disseminated chorioretinal inflammation of posterior pole, left eye
H30.113 Disseminated chorioretinal inflammation of posterior pole, bilateral
H30.121 Disseminated chorioretinal inflammation, peripheral right eye
H30.122 Disseminated chorioretinal inflammation, peripheral, left eye
H30.123 Disseminated chorioretinal inflammation, peripheral, bilateral


*Contains Public Information*
H30.131 Disseminated chorioretinal inflammation, generalized, right eye
H30.132 Disseminated chorioretinal inflammation, generalized, left eye
H30.133 Disseminated chorioretinal inflammation, generalized, bilateral
H30.141 Acute posterior multifocal placoid pigment epitheliopathy, right eye
H30.142 Acute posterior multifocal placoid pigment epitheliopathy, left eye
H30.143 Acute posterior multifocal placoid pigment epitheliopathy, bilateral
H30.21 Posterior cyclitis, right eye
H30.22 Posterior cyclitis, left eye
H30.23 Posterior cyclitis, bilateral
H30.811 Harada's disease, right eye
H30.812 Harada's disease, left eye
H30.813 Harada's disease, bilateral
H30.891 Other chorioretinal inflammations, right eye
H30.892 Other chorioretinal inflammations, left eye
H30.893 Other chorioretinal inflammations, bilateral
H30.91 Unspecified chorioretinal inflammation, right eye
H30.92 Unspecified chorioretinal inflammation, left eye
H30.93 Unspecified chorioretinal inflammation, bilateral
H31.101 Choroidal degeneration, unspecified, right eye
H31.102 Choroidal degeneration, unspecified, left eye
H31.103 Choroidal degeneration, unspecified, bilateral
H31.111 Age-related choroidal atrophy, right eye
H31.112 Age-related choroidal atrophy, left eye
H31.113 Age-related choroidal atrophy, bilateral
H31.121 Diffuse secondary atrophy of choroid, right eye
H31.122 Diffuse secondary atrophy of choroid, left eye
H31.123 Diffuse secondary atrophy of choroid, bilateral
H31.321 Choroidal rupture, right eye
H31.322 Choroidal rupture, left eye
H31.323 Choroidal rupture, bilateral
H31.401 Unspecified choroidal detachment, right eye
H31.402 Unspecified choroidal detachment, left eye
H31.403 Unspecified choroidal detachment, bilateral
H31.411 Hemorrhagic choroidal detachment, right eye
H31.412 Hemorrhagic choroidal detachment, left eye
H31.413 Hemorrhagic choroidal detachment, bilateral
H31.421 Serous choroidal detachment, right eye
H31.422 Serous choroidal detachment, left eye
H31.423 Serous choroidal detachment, bilateral
H32 Chorioretinal disorders in diseases classified elsewhere
H33.001 Unspecified retinal detachment with retinal break, right eye
H33.002 Unspecified retinal detachment with retinal break, left eye
H33.003 Unspecified retinal detachment with retinal break, bilateral
H33.011 Retinal detachment with single break, right eye
H33.012 Retinal detachment with single break, left eye
H33.013 Retinal detachment with single break, bilateral
H33.021 Retinal detachment with multiple breaks, right eye
H33.022 Retinal detachment with multiple breaks, left eye
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>H33.023</td>
<td>Retinal detachment with multiple breaks, bilateral</td>
</tr>
<tr>
<td>H33.031</td>
<td>Retinal detachment with giant retinal tear, right eye</td>
</tr>
<tr>
<td>H33.032</td>
<td>Retinal detachment with giant retinal tear, left eye</td>
</tr>
<tr>
<td>H33.033</td>
<td>Retinal detachment with giant retinal tear, bilateral</td>
</tr>
<tr>
<td>H33.041</td>
<td>Retinal detachment with retinal dialysis, right eye</td>
</tr>
<tr>
<td>H33.042</td>
<td>Retinal detachment with retinal dialysis, left eye</td>
</tr>
<tr>
<td>H33.043</td>
<td>Retinal detachment with retinal dialysis, bilateral</td>
</tr>
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<td>H33.051</td>
<td>Total retinal detachment, right eye</td>
</tr>
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<td>H33.052</td>
<td>Total retinal detachment, left eye</td>
</tr>
<tr>
<td>H33.053</td>
<td>Total retinal detachment, bilateral</td>
</tr>
<tr>
<td>H33.21</td>
<td>Serous retinal detachment, right eye</td>
</tr>
<tr>
<td>H33.22</td>
<td>Serous retinal detachment, left eye</td>
</tr>
<tr>
<td>H33.23</td>
<td>Serous retinal detachment, bilateral</td>
</tr>
<tr>
<td>H33.41</td>
<td>Traction detachment of retina, right eye</td>
</tr>
<tr>
<td>H33.42</td>
<td>Traction detachment of retina, left eye</td>
</tr>
<tr>
<td>H33.43</td>
<td>Traction detachment of retina, bilateral</td>
</tr>
<tr>
<td>H34.8110</td>
<td>Central retinal vein occlusion, right eye, with macular edema</td>
</tr>
<tr>
<td>H34.8111</td>
<td>Central retinal vein occlusion, right eye, with retinal neovascularization</td>
</tr>
<tr>
<td>H34.8112</td>
<td>Central retinal vein occlusion, right eye, stable</td>
</tr>
<tr>
<td>H34.8120</td>
<td>Central retinal vein occlusion, left eye, with macular edema</td>
</tr>
<tr>
<td>H34.8121</td>
<td>Central retinal vein occlusion, left eye, with retinal neovascularization</td>
</tr>
<tr>
<td>H34.8122</td>
<td>Central retinal vein occlusion, left eye, stable</td>
</tr>
<tr>
<td>H34.8130</td>
<td>Central retinal vein occlusion, bilateral, with macular edema</td>
</tr>
<tr>
<td>H34.8131</td>
<td>Central retinal vein occlusion, bilateral, with retinal neovascularization</td>
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<tr>
<td>H34.8132</td>
<td>Central retinal vein occlusion, bilateral, stable</td>
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<tr>
<td>H34.8310</td>
<td>Tributary (branch) retinal vein occlusion, right eye, with macular edema</td>
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<tr>
<td>H34.8311</td>
<td>Tributary (branch) retinal vein occlusion, right eye, with retinal neovascularization</td>
</tr>
<tr>
<td>H34.8312</td>
<td>Tributary (branch) retinal vein occlusion, right eye, stable</td>
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<tr>
<td>H34.8320</td>
<td>Tributary (branch) retinal vein occlusion, left eye, with macular edema</td>
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<td>H34.8321</td>
<td>Tributary (branch) retinal vein occlusion, left eye, with retinal neovascularization</td>
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<td>Tributary (branch) retinal vein occlusion, left eye, stable</td>
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<td>Tributary (branch) retinal vein occlusion, bilateral, with macular edema</td>
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<td>H34.8331</td>
<td>Tributary (branch) retinal vein occlusion, bilateral, with retinal neovascularization</td>
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<td>H34.8332</td>
<td>Tributary (branch) retinal vein occlusion, bilateral, stable</td>
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<tr>
<td>H35.051</td>
<td>Retinal neovascularization, unspecified, right eye</td>
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<tr>
<td>H35.052</td>
<td>Retinal neovascularization, unspecified, left eye</td>
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<tr>
<td>H35.053</td>
<td>Retinal neovascularization, unspecified, bilateral</td>
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<tr>
<td>H35.31</td>
<td>Nonexudative age-related macular degeneration</td>
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<tr>
<td>H35.3110</td>
<td>Nonexudative age-related macular degeneration, right eye, stage unspecified</td>
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<td>H35.3111</td>
<td>Nonexudative age-related macular degeneration, right eye, early dry stage</td>
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<tr>
<td>H35.3112</td>
<td>Nonexudative age-related macular degeneration, right eye, intermediate dry stage</td>
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<tr>
<td>H35.3113</td>
<td>Nonexudative age-related macular degeneration, right eye, advanced atrophic without subfoveal involvement</td>
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<tr>
<td>H35.3114</td>
<td>Nonexudative age-related macular degeneration, right eye, advanced atrophic with subfoveal involvement</td>
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<tr>
<td>H35.3120</td>
<td>Nonexudative age-related macular degeneration, left eye, stage unspecified</td>
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<tr>
<td>H35.3121</td>
<td>Nonexudative age-related macular degeneration, left eye, early dry stage</td>
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H35.3122 Nonexudative age-related macular degeneration, left eye, intermediate dry stage
H35.3123 Nonexudative age-related macular degeneration, left eye, advanced atrophic without subfoveal involvement
H35.3124 Nonexudative age-related macular degeneration, left eye, advanced atrophic with subfoveal involvement
H35.3130 Nonexudative age-related macular degeneration, bilateral, stage unspecified
H35.3131 Nonexudative age-related macular degeneration, bilateral, early dry stage
H35.3132 Nonexudative age-related macular degeneration, bilateral, intermediate dry stage
H35.3133 Nonexudative age-related macular degeneration, bilateral, advanced atrophic without subfoveal involvement
H35.3134 Nonexudative age-related macular degeneration, bilateral, advanced atrophic with subfoveal involvement
H35.3210 Exudative age-related macular degeneration, right eye, stage unspecified
H35.3211 Exudative age-related macular degeneration, right eye, with active choroidal neovascularization
H35.3212 Exudative age-related macular degeneration, right eye, with inactive choroidal neovascularization
H35.3213 Exudative age-related macular degeneration, right eye, with inactive scar
H35.3220 Exudative age-related macular degeneration, left eye, stage unspecified
H35.3221 Exudative age-related macular degeneration, left eye, with active choroidal neovascularization
H35.3222 Exudative age-related macular degeneration, left eye, with inactive choroidal neovascularization
H35.3223 Exudative age-related macular degeneration, left eye, with inactive scar
H35.3230 Exudative age-related macular degeneration, bilateral, stage unspecified
H35.3231 Exudative age-related macular degeneration, bilateral, with active choroidal neovascularization
H35.3232 Exudative age-related macular degeneration, bilateral, with inactive choroidal neovascularization
H35.3233 Exudative age-related macular degeneration, bilateral, with inactive scar
H35.33 Angioid streaks of macula
H35.341 Macular cyst, hole, or pseudohole, right eye
H35.342 Macular cyst, hole, or pseudohole, left eye
H35.343 Macular cyst, hole, or pseudohole, bilateral
H35.351 Cystoid macular degeneration, right eye
H35.352 Cystoid macular degeneration, left eye
H35.353 Cystoid macular degeneration, bilateral
H35.361 Drusen (degenerative) of macula, right eye
H35.362 Drusen (degenerative) of macula, left eye
H35.363 Drusen (degenerative) of macula, bilateral
H35.371 Puckering of macula, right eye
H35.372 Puckering of macula, left eye
H35.373 Puckering of macula, bilateral
H35.50 Unspecified hereditary retinal dystrophy
H35.51 Vitreoretinal dystrophy
H35.53 Other dystrophies primarily involving the sensory retina
H35.54 Dystrophies primarily involving the retinal pigment epithelium
H35.711 Central serous chorioretinopathy, right eye
H35.712  Central serous chorioretinopathy, left eye
H35.713  Central serous chorioretinopathy, bilateral
H35.81   Retinal edema
H35.89   Other specified retinal disorders
H40.001  Preglaucoma, unspecified, right eye
H40.002  Preglaucoma, unspecified, left eye
H40.003  Preglaucoma, unspecified, bilateral
H40.011  Open angle with borderline findings, low risk, right eye
H40.012  Open angle with borderline findings, low risk, left eye
H40.013  Open angle with borderline findings, low risk, bilateral
H40.021  Open angle with borderline findings, high risk, right eye
H40.022  Open angle with borderline findings, high risk, left eye
H40.023  Open angle with borderline findings, high risk, bilateral
H40.031  Anatomical narrow angle, right eye
H40.032  Anatomical narrow angle, left eye
H40.033  Anatomical narrow angle, bilateral
H40.041  Steroid responder, right eye
H40.042  Steroid responder, left eye
H40.043  Steroid responder, bilateral
H40.051  Ocular hypertension, right eye
H40.052  Ocular hypertension, left eye
H40.053  Ocular hypertension, bilateral
H40.10X1 Unspecified open-angle glaucoma, mild stage
H40.10X2 Unspecified open-angle glaucoma, moderate stage
H40.10X3 Unspecified open-angle glaucoma, severe stage
H40.10X4 Unspecified open-angle glaucoma, indeterminate stage
H40.1110 Primary open-angle glaucoma, right eye, stage unspecified
H40.1111 Primary open-angle glaucoma, right eye, mild stage
H40.1112 Primary open-angle glaucoma, right eye, moderate stage
H40.1113 Primary open-angle glaucoma, right eye, severe stage
H40.1114 Primary open-angle glaucoma, right eye, indeterminate stage
H40.1120 Primary open-angle glaucoma, left eye, stage unspecified
H40.1121 Primary open-angle glaucoma, left eye, mild stage
H40.1122 Primary open-angle glaucoma, left eye, moderate stage
H40.1123 Primary open-angle glaucoma, left eye, severe stage
H40.1124 Primary open-angle glaucoma, left eye, indeterminate stage
H40.1130 Primary open-angle glaucoma, bilateral, stage unspecified
H40.1131 Primary open-angle glaucoma, bilateral, mild stage
H40.1132 Primary open-angle glaucoma, bilateral, moderate stage
H40.1133 Primary open-angle glaucoma, bilateral, severe stage
H40.1134 Primary open-angle glaucoma, bilateral, indeterminate stage
H40.1210 Low-tension glaucoma, right eye, stage unspecified
H40.1211 Low-tension glaucoma, right eye, mild stage
H40.1212 Low-tension glaucoma, right eye, moderate stage
H40.1213 Low-tension glaucoma, right eye, severe stage
H40.1214 Low-tension glaucoma, right eye, indeterminate stage
H40.1220 Low-tension glaucoma, left eye, stage unspecified
H40.1221 Low-tension glaucoma, left eye, mild stage
H40.1222 Low-tension glaucoma, left eye, moderate stage
H40.1223 Low-tension glaucoma, left eye, severe stage
H40.1224 Low-tension glaucoma, left eye, indeterminate stage
H40.1231 Low-tension glaucoma, bilateral, mild stage
H40.1232 Low-tension glaucoma, bilateral, moderate stage
H40.1234 Low-tension glaucoma, bilateral, indeterminate stage
H40.1311 Pigmentary glaucoma, right eye, mild stage
H40.1312 Pigmentary glaucoma, right eye, moderate stage
H40.1313 Pigmentary glaucoma, right eye, severe stage
H40.1314 Pigmentary glaucoma, right eye, indeterminate stage
H40.1321 Pigmentary glaucoma, left eye, mild stage
H40.1322 Pigmentary glaucoma, left eye, moderate stage
H40.1324 Pigmentary glaucoma, left eye, indeterminate stage
H40.1331 Pigmentary glaucoma, bilateral, mild stage
H40.1332 Pigmentary glaucoma, bilateral, moderate stage
H40.1333 Pigmentary glaucoma, bilateral, severe stage
H40.1334 Pigmentary glaucoma, bilateral, indeterminate stage
H40.1411 Capsular glaucoma with pseudoexfoliation of lens, right eye, mild stage
H40.1412 Capsular glaucoma with pseudoexfoliation of lens, right eye, moderate stage
H40.1413 Capsular glaucoma with pseudoexfoliation of lens, right eye, severe stage
H40.1414 Capsular glaucoma with pseudoexfoliation of lens, right eye, indeterminate stage
H40.1421 Capsular glaucoma with pseudoexfoliation of lens, left eye, mild stage
H40.1422 Capsular glaucoma with pseudoexfoliation of lens, left eye, moderate stage
H40.1423 Capsular glaucoma with pseudoexfoliation of lens, left eye, severe stage
H40.1431 Capsular glaucoma with pseudoexfoliation of lens, bilateral, mild stage
H40.1432 Capsular glaucoma with pseudoexfoliation of lens, bilateral, moderate stage
H40.1433 Capsular glaucoma with pseudoexfoliation of lens, bilateral, severe stage
H40.1434 Capsular glaucoma with pseudoexfoliation of lens, bilateral, indeterminate stage
H40.151 Residual stage of open-angle glaucoma, right eye
H40.152 Residual stage of open-angle glaucoma, left eye
H40.153 Residual stage of open-angle glaucoma, bilateral
H40.20X1 Unspecified primary angle-closure glaucoma, mild stage
H40.20X2 Unspecified primary angle-closure glaucoma, moderate stage
H40.20X3 Unspecified primary angle-closure glaucoma, severe stage
H40.20X4 Unspecified primary angle-closure glaucoma, indeterminate stage
H40.211 Acute angle-closure glaucoma, right eye
H40.212 Acute angle-closure glaucoma, left eye
H40.213 Acute angle-closure glaucoma, bilateral
H40.2211 Chronic angle-closure glaucoma, right eye, mild stage
H40.2212 Chronic angle-closure glaucoma, right eye, moderate stage
H40.2213 Chronic angle-closure glaucoma, right eye, severe stage
H40.2214 Chronic angle-closure glaucoma, right eye, indeterminate stage
H40.2221 Chronic angle-closure glaucoma, left eye, mild stage
H40.2222 Chronic angle-closure glaucoma, left eye, moderate stage
H40.2223 Chronic angle-closure glaucoma, left eye, severe stage
H40.2224  Chronic angle-closure glaucoma, left eye, indeterminate stage
H40.2231  Chronic angle-closure glaucoma, bilateral, mild stage
H40.2232  Chronic angle-closure glaucoma, bilateral, moderate stage
H40.2233  Chronic angle-closure glaucoma, bilateral, severe stage
H40.2234  Chronic angle-closure glaucoma, bilateral, indeterminate stage
H40.231   Intermittent angle-closure glaucoma, right eye
H40.232   Intermittent angle-closure glaucoma, left eye
H40.233   Intermittent angle-closure glaucoma, bilateral
H40.241   Residual stage of angle-closure glaucoma, right eye
H40.242   Residual stage of angle-closure glaucoma, left eye
H40.243   Residual stage of angle-closure glaucoma, bilateral
H40.31X1  Glaucoma secondary to eye trauma, right eye, mild stage
H40.31X2  Glaucoma secondary to eye trauma, right eye, moderate stage
H40.31X3  Glaucoma secondary to eye trauma, right eye, severe stage
H40.31X4  Glaucoma secondary to eye trauma, right eye, indeterminate stage
H40.32X1  Glaucoma secondary to eye trauma, left eye, mild stage
H40.32X2  Glaucoma secondary to eye trauma, left eye, moderate stage
H40.32X3  Glaucoma secondary to eye trauma, left eye, severe stage
H40.32X4  Glaucoma secondary to eye trauma, left eye, indeterminate stage
H40.33X1  Glaucoma secondary to eye trauma, bilateral, mild stage
H40.33X2  Glaucoma secondary to eye trauma, bilateral, moderate stage
H40.33X3  Glaucoma secondary to eye trauma, bilateral, severe stage
H40.33X4  Glaucoma secondary to eye trauma, bilateral, indeterminate stage
H40.41X1  Glaucoma secondary to eye inflammation, right eye, mild stage
H40.41X2  Glaucoma secondary to eye inflammation, right eye, moderate stage
H40.41X3  Glaucoma secondary to eye inflammation, right eye, severe stage
H40.41X4  Glaucoma secondary to eye inflammation, right eye, indeterminate stage
H40.42X1  Glaucoma secondary to eye inflammation, left eye, mild stage
H40.42X2  Glaucoma secondary to eye inflammation, left eye, moderate stage
H40.42X3  Glaucoma secondary to eye inflammation, left eye, severe stage
H40.42X4  Glaucoma secondary to eye inflammation, left eye, indeterminate stage
H40.43X1  Glaucoma secondary to eye inflammation, bilateral, mild stage
H40.43X2  Glaucoma secondary to eye inflammation, bilateral, moderate stage
H40.43X3  Glaucoma secondary to eye inflammation, bilateral, severe stage
H40.43X4  Glaucoma secondary to eye inflammation, bilateral, indeterminate stage
H40.51X1  Glaucoma secondary to other eye disorders, right eye, mild stage
H40.51X2  Glaucoma secondary to other eye disorders, right eye, moderate stage
H40.51X3  Glaucoma secondary to other eye disorders, right eye, severe stage
H40.51X4  Glaucoma secondary to other eye disorders, right eye, indeterminate stage
H40.52X1  Glaucoma secondary to other eye disorders, left eye, mild stage
H40.52X2  Glaucoma secondary to other eye disorders, left eye, moderate stage
H40.52X3  Glaucoma secondary to other eye disorders, left eye, severe stage
H40.52X4  Glaucoma secondary to other eye disorders, left eye, indeterminate stage
H40.53X1  Glaucoma secondary to other eye disorders, bilateral, mild stage
H40.53X2  Glaucoma secondary to other eye disorders, bilateral, moderate stage
H40.53X3  Glaucoma secondary to other eye disorders, bilateral, severe stage
H40.53X4  Glaucoma secondary to other eye disorders, bilateral, indeterminate stage
H40.61X1  Glaucoma secondary to drugs, right eye, mild stage
H40.61X2 Glaucoma secondary to drugs, right eye, moderate stage
H40.61X3 Glaucoma secondary to drugs, right eye, severe stage
H40.61X4 Glaucoma secondary to drugs, right eye, indeterminate stage
H40.62X1 Glaucoma secondary to drugs, left eye, mild stage
H40.62X2 Glaucoma secondary to drugs, left eye, moderate stage
H40.62X3 Glaucoma secondary to drugs, left eye, severe stage
H40.62X4 Glaucoma secondary to drugs, left eye, indeterminate stage
H40.63X1 Glaucoma secondary to drugs, bilateral, mild stage
H40.63X2 Glaucoma secondary to drugs, bilateral, moderate stage
H40.63X3 Glaucoma secondary to drugs, bilateral, severe stage
H40.63X4 Glaucoma secondary to drugs, bilateral, indeterminate stage
H40.811 Glaucoma with increased episcleral venous pressure, right eye
H40.812 Glaucoma with increased episcleral venous pressure, left eye
H40.813 Glaucoma with increased episcleral venous pressure, bilateral
H40.821 Hypersecretion glaucoma, right eye
H40.822 Hypersecretion glaucoma, left eye
H40.823 Hypersecretion glaucoma, bilateral
H40.831 Aqueous misdirection, right eye
H40.832 Aqueous misdirection, left eye
H40.833 Aqueous misdirection, bilateral
H40.89 Other specified glaucoma
H40.9 Unspecified glaucoma
H42 Glaucoma in diseases classified elsewhere
H43.811 Vitreous degeneration, right eye
H43.812 Vitreous degeneration, left eye
H43.813 Vitreous degeneration, bilateral
H43.821 Vitreomacular adhesion, right eye
H43.822 Vitreomacular adhesion, left eye
H43.823 Vitreomacular adhesion, bilateral
H44.21 Degenerative myopia, right eye
H44.22 Degenerative myopia, left eye
H44.23 Degenerative myopia, bilateral
H44.2A1 Degenerative myopia with choroidal neovascularization, right eye
H44.2A2 Degenerative myopia with choroidal neovascularization, left eye
H44.2A3 Degenerative myopia with choroidal neovascularization, bilateral eye
H44.2B1 Degenerative myopia with macular hole, right eye
H44.2B2 Degenerative myopia with macular hole, left eye
H44.2B3 Degenerative myopia with macular hole, bilateral eye
H44.2C1 Degenerative myopia with retinal detachment, right eye
H44.2C2 Degenerative myopia with retinal detachment, left eye
H44.2C3 Degenerative myopia with retinal detachment, bilateral eye
H44.2D1 Degenerative myopia with foveoschisis, right eye
H44.2D2 Degenerative myopia with foveoschisis, left eye
H44.2D3 Degenerative myopia with foveoschisis, bilateral eye
H44.2E1 Degenerative myopia with other maculopathy, right eye
H44.2E2 Degenerative myopia with other maculopathy, left eye
H47.031 Optic nerve hypoplasia, right eye
H47.032 Optic nerve hypoplasia, left eye
H47.033  Optic nerve hypoplasia, bilateral
H47.20   Unspecified optic atrophy
H47.211  Primary optic atrophy, right eye
H47.212  Primary optic atrophy, left eye
H47.213  Primary optic atrophy, bilateral
H47.22   Hereditary optic atrophy
H47.231  Glaucomatous optic atrophy, right eye
H47.232  Glaucomatous optic atrophy, left eye
H47.233  Glaucomatous optic atrophy, bilateral
H47.291  Other optic atrophy, right eye
H47.292  Other optic atrophy, left eye
H47.293  Other optic atrophy, bilateral
H47.321  Drusen of optic disc, right eye
H47.322  Drusen of optic disc, left eye
H47.323  Drusen of optic disc, bilateral
H47.331  Pseudopapilledema of optic disc, right eye
H47.332  Pseudopapilledema of optic disc, left eye
H47.333  Pseudopapilledema of optic disc, bilateral
H47.391  Other disorders of optic disc, right eye
H47.392  Other disorders of optic disc, left eye
H47.393  Other disorders of optic disc, bilateral
H53.411  Scotoma involving central area, right eye
H53.412  Scotoma involving central area, left eye
H53.413  Scotoma involving central area, bilateral
Q15.0   Congenital glaucoma
Z79.899  Other long term (current) drug therapy

REVISIONS

04-19-2007 effective 07-01-2007
- Added the indications for OCT use for diagnosing and monitoring glaucoma, nerve fiber, and optic nerve conditions.

05-09-2007 effective 11-01-2007
- The policy section was updated to split the first bullet under B. to create two bullets, one for age-related macular degeneration and one for diabetic macular edema and to set a maximum number of OCT services per year for each.

04-30-2010
- In Policy Section:
  - Revised repeat testing For Diabetic Macular Edema (DME), from "Repeat every 2 or 3 months" to "Repeat every 3 or 4 months"
  - Revised repeat testing For Epiretinal Membrane (ERM) from "pre-treatment and post-surgical at 3 months, 6 months" to "pre-treatment and post-surgical after 6 weeks, 6 months".
  - Added "If Cystoid Macular Edema: Repeat every 2 months during acute treatment."
  - Added "If Branch Retinal Vein Occlusion: Repeat every 3 or 4 months indefinitely."
  - Added "If Central Retinal Vein Occlusion: Repeat every 3 or 4 months for approximately 2 years"
  - Added "If Macular Drusen: Repeat annually, allowing one study by treating MD / OD per year."
  - Corrected wording of "treating MD / OD" to "treating MD / DO"
In Coding Section:
- Updated wording for CPT code 92135.
- Confirmed no diagnosis codes listed for OCT for the rhegmatogenous retinal detachment (361.00-361.07)
- Added diagnosis code 362.51.

10-26-2010
In Policy Section:
- Item A, inserted ", retinal conditions" to read "Scanning Laser Ophthalmoscopy (SLO) test is allowable for the diagnoses and the monitoring of the optic nerve, retinal conditions, and glaucoma."
- Item B, #1 through #3, removed "by treating MD/DO" to read:
  1. If Exudative Age-related Macular Degeneration (AMD): Repeat OCT will significantly help guide the need for retreatment (with photodynamic therapy [PDT] or intravitreal injections) in conjunction with intravenous fluorescein angiography (IVF) / indocyanine green (ICG). Maximum of 8 per year linked to intravitreal injections.
  2. If Diabetic Macular Edema (DME): Repeat 3 or 4 months (maximum of 4 per year linked to intravitreal injections / or laser treatment.
  3. If Retinal Detachment (RD): Repeat pre-treatment and post-surgical at 2 months (maximum of 2).
  4. If Epiretinal Membrane (ERM): Repeat pre-treatment and post-surgical after 6 weeks, 6 months (maximum of 3) if with macular edema.
- Item B, #7, replaced "indefinitely," with "for approximately two years." To read "Repeat every 3 or 4 months for approximately two years."
- Item B, #9, replaced "allowing one study by treating MD/DO per year" with "if subjective visual changes or suspicion of choroidal neovascularization: if more than two studies per year, then documentation is required" to read "Repeat annually, if subjective visual changes or suspicion of choroidal neovascularization: if more than two studies per year, then documentation is required."

In the Medical Policy Title Section:
- Replaced "Scanning Laser Ophthalmoscopy (SLO) for Glaucoma and Optical Coherence Tomography (OCT) for Retinal Conditions" with "Scanning Computerized Ophthalmic Diagnostic Imaging Devices."

02-16-2011
In Coding section:
- Added CPT codes: 92133, 92134, 92227, 92228.
- Removed CPT code: 92135.

01-01-2012
In the Coding section:
- Removed HCPCS code: S0625

01-15-2013
In the Policy section:
- In Item B, revised the following statement, "Optical Coherence (OCT) test is allowed for the diagnoses and the monitoring for retinal conditions." to "Optical Coherence (OCT) test is allowed for the diagnoses, listed below, monitoring for retinal conditions, and ocular toxicity secondary to high-risk medications (i.e., chloroquine [Aralen], hydroxychloroquine [Plaquenil], Interferon alpha-2b, Amiodarone, tamoxifen citrate [Nolvadex], fingolimod [Gilenya], Seroquel)."

In Coding section:
- Added Diagnosis codes: 362.57, 379.21, V58.69.

01-22-2013
Corrections were made to the Current Effective Date and the Revision Date section.

07-30-2013
In Policy section:
- Item B, 9 moved to become new #2.
- In new Item B, 2, inserted "only" to read "Repeat annually, only if subjective visual changes..."
<table>
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<tr>
<th>Date</th>
<th>Description</th>
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<tr>
<td>04-28-2015</td>
<td>Updated Reference section. Updated Description section. Updated Rationale section. In Coding section:</td>
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<tr>
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<td>Added ICD-10 Diagnosis codes (Effective October 1, 2014)</td>
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<td>08-19-2015</td>
<td>In Policy section:</td>
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<td>In Item B 3, added &quot;8&quot; and removed &quot;Repeat every 3 or 4 months&quot; and &quot;4&quot;, to read &quot;Maximum of 8 per year linked to intravitreal injections or laser treatment.&quot;</td>
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<td>In Item B 5, removed &quot;after 6 weeks, 6 months&quot;, and &quot;3&quot;, to read &quot;Repeat pre-treatment and post-surgical (maximum of 4 per year) if with macular edema.&quot;</td>
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<td>In Item B 6, removed &quot;at 2 or 3 months&quot; and added &quot;maximum of 4 per year in&quot;, to read &quot;Repeat pre-treatment and post-treatment (maximum of 4 per year) in cases of partially closed hole.&quot;</td>
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<td>In Item B 8, removed &quot;Repeat every 3 or 4 months for approximately 2 years&quot; and added &quot;Maximum of 8 per year linked to intravitreal injections&quot;</td>
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<td>In Item B 9, removed &quot;Repeat every 3 or 4 months for approximately 2 years&quot; and added &quot;Maximum of 8 per year linked to intravitreal injections&quot;</td>
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<td>Removed ICD-10 diagnosis codes: H40.009, H40.141, H40.142, H40.143, H40.1511,</td>
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<td>Added ICD-10 diagnosis codes: H35.361, H35.362, H35.363, H40.1411, H40.1412,</td>
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<td>10-01-2015</td>
<td>Policy published 05-25-2016. Retro-effective to 10-01-2015 with ICD-10 coding implementation. In Coding section:</td>
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<td>Added ICD-10 diagnosis codes: H40.021, H40.022, H40.023, H40.31X1, H40.31X2,</td>
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<td>Added ICD-10 codes effective 10-01-2016: E08.3211, E08.3212, E08.3213,</td>
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**In Policy section:**

- In Item B, removed "diagnosis" and "and the" and added "diagnoses, listed below" and ",", and ocular toxicity secondary to high-risk medications (ie, chloroquine [Aralen], hydroxychloroquine [Plaquenil], Interferon alpha-2b, Amiodarone, tamoxifen citrate [Nolvadex], fingolimod [Gilenya], Seroquel)" to read, "Optical Coherence Tomography (OCT) test is allowed for the diagnoses, listed below, and the monitoring for retinal conditions, and ocular toxicity secondary to high-risk medications (ie, chloroquine [Aralen], hydroxychloroquine [Plaquenil], Interferon alpha-2b, Amiodarone, tamoxifen citrate [Nolvadex], fingolimod [Gilenya], Seroquel]." *(These revisions to policy language were inadvertently removed in the revision of 07-30-2013.)*

**Updated Rationale section.**

**In Coding section:**

- Added CPT code: 0198T.
- Removed CPT codes: 92227, 92228.
- Added ICD-10 codes: H33.001, H33.002, H33.003, H33.011, H33.012, H33.013, H33.014, H33.021, H33.022, H33.023, H33.031, H33.032, H33.033, H33.041, H33.042,
H33.043, H33.051, H33.052, H33.053, H35.50, H35.51, H35.53, H35.54, H43.811, H43.812, H43.813, H47.031, H47.032, H47.033, H47.20, H47.211, H47.212, H47.213, H47.22, H47.291, H47.292, H47.293, H47.321, H47.322, H47.323, H47.331, H47.332, H47.333, H47.391, H47.392, H47.393.

In Revision section, revision date was changed from "01-15-2012" to "01-15-2013."

Updated References section.

10-01-2017

In Coding section:
- Added ICD-10 codes: H44.2A1, H44.2A2, H44.2A3, H44.2B1, H44.2B2, H44.2B3, H44.2C1, H44.2C2, H44.2C3, H44.2D1, H44.2D2, H44.2D3, H44.2E1, H44.2E2, H44.2E3.

Updated References section.

04-11-2018

Updated Description section.
Updated Rationale section.

In Coding section:
- Removed ICD-9 codes.

Updated References section.

08-01-2018

In Policy section:
- Added new Item B 10, "If Vitreomacular Traction / Adhesion: Maximum of 4 per year."

In Coding section:
- Added ICD-10 codes: H43.821, H43.822, H43.823.

Updated References section.

04-15-2019


In Coding section:
- Added ICD-10 code: H35.051.

REFERENCES


**Other References**


2. Blue Cross and Blue Shield of Kansas Ophthalmology Liaison Committee minutes, May 9, 2007.


6. Blue Cross and Blue Shield of Kansas Optometry Liaison Committee, June 2010; May 2013; August 2016.

7. Blue Cross and Blue Shield of Kansas Ophthalmology/Optometry Liaison Committee, February 2017; May 2018.