Diagnostic Testing in Glaucoma

Several tests are available to help diagnose and treat glaucoma. Your doctor may order one or more of these tests during your office visits. These tests evaluate your vision and the parts of the eye that may be affected by glaucoma, by examining either the structure of the eye or the function of the visual system.

Perimetry

What is perimetry?
Perimetry, or visual field testing, is the measurement of your field of vision. Your visual field is the total area in which objects can be seen in the side (peripheral) vision while you focus your eyes on a central point. Perimetry allows the doctor to measure the areas of your field that are normal or which contain a scotoma. Loss of part of the visual field can occur for many reasons, such as glaucoma, cataract, and retinal diseases as well as other diseases of the optic nerve or visual system in the brain. Glaucoma causes typical patterns of damage to your visual field that your doctor is able to assess when analyzing the test results.

Why is it important?
Perimetry is an important test to assess the status of your vision and define if or how much of it has been lost from glaucoma. It is used to determine the severity of glaucoma and to monitor changes due to disease progression. The results of this test may influence the decisions about your treatment.

How is the test done?
During visual field testing, which is done on one eye at a time, the machine shows a series of small lights at different locations and of different brightness while you focus on one point in the center. When you see the light – without moving your eye – you should click the button so the computer can record it. You should not be worried if you do not always see the light. The test is designed to find the lowest level of light that you can see, and will sometimes show you lights that are too dim to be seen. After all of the lights are shown, the computer will gather the information based on your responses and provide a report with the results (Figure 1). Darker areas on the printout indicate where the vision is not as good as is normal for non-glaucoma patients of your age.

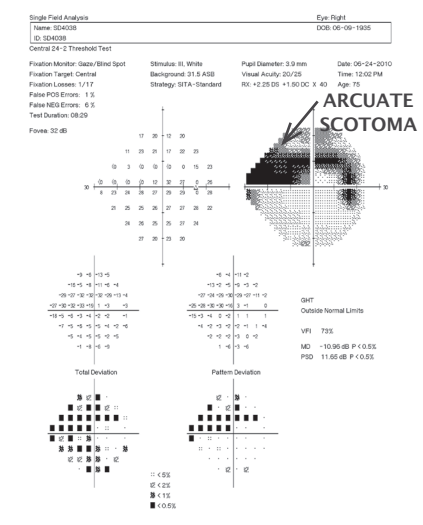

FIGURE 1

Visual field printout showing a defect from glaucoma.

Your doctor will ask you to repeat the visual field at intervals to assess whether there is change caused by glaucoma. In mild glaucoma, the visual field is normal. In moderate or severe glaucoma, dark areas will appear on the printout, which can become darker or larger if the glaucoma worsens. If the glaucoma is worsening it can be seen by a decrease in the overall sensitivity or an enlargement of the damaged area.

EYE WORDS TO KNOW

BLIND SPOT
This is a normal point of the visual field where we cannot see. It appears as a black spot in the printout. It corresponds to the location of the optic nerve, where there are no nerve cells to detect light.

CUP
The central part of the disc that does not contain nerve fibers.

DISC
The visible portion of the optic nerve as it leaves the back of the eye.

FOVEA
This is the central-most part of the retina. This area is responsible for sharp vision.

MACULA
Part of the retina where most of the nerve cells are located. This area can become thinned in conditions like glaucoma.

NERVE FIBER LAYER
This is a layer of the retina that is composed of nerve tissue. The damage caused by glaucoma can lead to thinning of this layer.

OPTIC NERVE
Bundle of nerve fibers that connect the retina to the brain.

RETINA
The back part of the eye, where light-sensitive cells called photoreceptors detect light and transmit the information to the brain, where it is converted into an image.

SCOTOMA
An area of poor or no vision. Scotomas can be physiologic (such as your 'blind spot') or due to damage (such as glaucoma and other eye diseases).

AMERICAN GLAUCOMA SOCIETY

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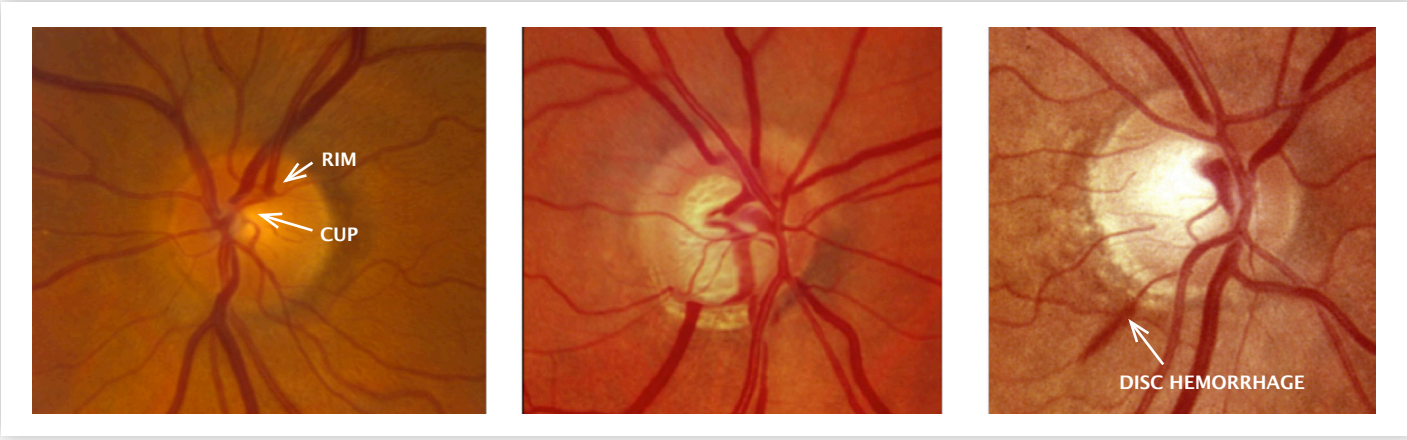

FIGURE 2

Optic nerve head photographs. Left: A normal optic nerve showing a small central cup with a surrounding rim of nerve tissue. Middle: An optic nerve with glaucoma showing loss of the neural tissue (rim) and enlargement of the cup. Right: An optic nerve with glaucoma showing an optic disc hemorrhage.

Optic Disc Photography

What is optic disc photography?
Optic disc photography is an examination in which we take a picture of the retina and optic nerve.

Why is it important?
Because glaucoma involves injury to the optic nerve, these photographs may help your doctor to diagnose glaucoma and detect signs of worsening. By taking photographs over time, your doctor may compare the appearance of the optic nerve over several years in order to tell if the glaucoma is progressing or is stable.

How is the test done?
You will be asked to look at a target while the technician takes a picture. Usually your pupils will be dilated for the test. Figure 2 (left) shows what the optic nerve looks like in a person without glaucoma. The nerve looks like a doughnut. The central part ('doughnut hole') is called the 'cup'. The ring around the cup (the 'doughnut' itself) is made of nerve tissue and is called the 'rim'. The cup and rim together are sometimes called the "disc." In glaucoma, there is enlargement of the cup because of loss of nerve tissue (Figure 2, middle). In addition to evaluating nerve tissue loss, optic disc photography may also help your doctor detect other signs of glaucoma, such as small bleeding spots called disc hemorrhages (Figure 2, right). These spots usually disappear in a few months, but can be an sign that your glaucoma treatment may need to be changed.

Computerized Imaging

What is computerized imaging?
Computerized imaging is another common test to look for loss of nerve tissue caused by glaucoma. These tests give high-definition microscopic images of the retina, macula and optic nerve. Unlike photographs, this test measures the thickness of nerve cells and fibers and checks if the measurements of your retina are similar to those expected in people your age. Eyes with thinner nerve fiber layers are more likely to have glaucoma.

Why is it important?
Computerized imaging devices measure the tissue that is affected by glaucoma. In addition to helping detect early signs of glaucoma, they can help your doctor evaluate if glaucoma is progressing or is stable. Results from computerized imaging should be interpreted along with medical history, physical examination and other tests such as visual fields in order to diagnose the presence or worsening of glaucoma.

How is the test done?
In general, these devices use laser light to take images of the structures in the back of the eye. The light used is safe for the eyes and the whole test can usually be done in just a few minutes. After the images are taken, the device makes a printout showing the results. Figure 3 shows an example of printouts using one of the imaging devices, called optical coherence tomography (OCT), from someone without glaucoma (left) and someone with glaucoma (right). The OCT software shows normal (green), borderline (yellow), or abnormal (red) based on the thickness of the nerve cells and fibers. This is shown for each tested eye (OD= right eye; OS= left eye). The presence of abnormal areas will help the doctor diagnose if you have glaucoma or if your glaucoma is worsening.

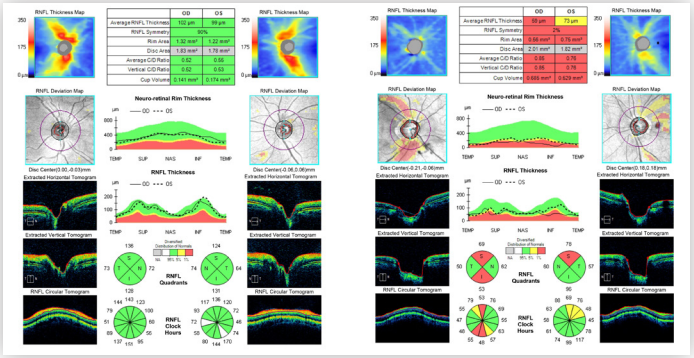

FIGURE 3

Printouts of OCT imaging of the retinal nerve fiber layer. The printout on the left is from a normal person and the one on the right is from someone with glaucoma. In the "RNFL Thickness Map", areas of thicker nerve fiber layer appear as red and yellow. The eyes of the glaucoma patient show a thinner nerve fiber layer than those of the healthy subject. The loss of nerve tissue in glaucoma is also indicated by several different measurements shown on the printout.