Age-Related Macular Degeneration

Age-related macular degeneration (AMD) is one of the most common causes of poor vision after age 60. AMD is a deterioration or breakdown of the **macula**. The macula is a small area at the center of the retina in the back of the eye that allows us to see fine details clearly and perform activities such as reading and driving.

The visual symptoms of AMD involve loss of central vision. While peripheral (side) vision is unaffected, with AMD, one loses the sharp, straight-ahead vision necessary for driving, reading, recognizing faces, and looking at detail.

Although the specific cause is unknown, AMD seems to be part of aging. While age is the most significant risk factor for developing AMD, heredity, blue eyes, high blood pressure, cardiovascular disease, and smoking have also been identified as risk factors. AMD accounts for 90% of new cases of legal blindness in the United States.

Nine out of 10 people who have AMD have **atrophic** or **" dry" AMD,** which results in thinning of the macula. Dry AMD takes many years to develop. A specific vitamin regimen has been shown to slow progression of dry AMD.

Exudative or **" wet" AMD** is less common (occurring in one out of 10 people with AMD) but is more serious. In the wet form of AMD, abnormal blood vessels may grow in a layer beneath the retina, leaking fluid and blood and creating distortion or a large blind spot in the center of your vision. If the blood vessels are not growing directly beneath the macula, laser surgery is usually the treatment of choice. The procedure usually does not improve vision but tries to prevent further loss of vision. For those patients with wet AMD whose blood vessels are growing directly under the center of the macula, intravitreal injections of certain medications can be used in these cases. A procedure called **photodynamic therapy (PDT)** is sometimes used.

Promising AMD research is being done on many fronts. In the meantime, high-intensity reading lamps, magnifiers, and other low vision aids help people with AMD make the most of their remaining vision.

Anti-VEGF Treatment for Non-AMD Disease

Researchers have found that a chemical called vascular endothelial growth factor, or VEGF, is critical in causing abnormal blood vessels to grow under the retina. Scientists have developed several new drugs that can block the trouble-causing VEGF known as "anti-VEGF" drugs. They help block abnormal blood vessels, slow their leakage, and help reduce vision loss.

Certain anti-VEGF treatments are approved for a condition known as **"wet" age-related macular degeneration (AMD)**, in which abnormal blood vessels grow underneath the retina. These unhealthy vessels leak blood and fluid that can swell and scar the macula (the central part of the retina), and vision loss may be rapid and severe.

Since anti-VEGF therapies have shown good potential for slowing vascular leakage and preventing vision loss associated with wet AMD, retinal specialists are using them to treat other causes of macular edema. If your ophthalmologist has diagnosed you with **diabetic retinopathy**, **retinal venous occlusion**, or other conditions, you may benefit from anti-VEGF treatment if other therapies are not producing the desired results or if your ophthalmologist thinks that anti-VEGF therapy is the best first course of action.

Treatment with the anti-VEGF drug is usually performed by injecting the medicine with a very fine needle into the back portion of your eye. Your ophthalmologist will clean your eye to prevent infection and will administer an anesthetic into your eye to reduce pain. Usually, patients receive multiple anti-VEGF injections over the course of many months. There is a small risk of complications with anti-VEGF treatment, usually resulting from the injection itself. However, for most people, the benefits of this treatment outweigh the small risk of complications.

Anti-VEGF Treatment for Wet Age-Related Macular Degeneration

Anti-VEGF treatment is a way to slow vision loss in people who have a condition known as "wet" age-related macular degeneration (AMD).

AMD is the leading cause of vision loss in people 50 years or older in the United States. This condition damages the **macula**, which is located in the center of the retina and enables you to see fine details clearly. You rely on your macula whenever you read, drive, or do other activities that require you to focus on precise details. A person with AMD loses the ability to perceive fine details both up close and at a distance. This vision loss usually affects only your central vision.

There are two types of AMD. About 90% of people with AMD have the atrophic or **"dry"** form of AMD, which develops when the tissues of the macula grow thin with age. About 10% have the exudative or **"wet"** form of AMD. With wet AMD, abnormal blood vessels grow underneath the retina. These unhealthy vessels leak blood and fluid, which can scar the macula. Vision loss can be rapid and severe.

Researchers have found that a chemical called **vascular endothelial growth factor**, or **VEGF**, is critical in causing abnormal blood vessels to grow under the retina. Scientists have developed several new drugs that can block the trouble-causing VEGF. These are referred to as "anti-VEGF" drugs, and they help block abnormal blood vessels, slow their leakage, and help reduce vision loss.

Treatment with the anti-VEGF drug is usually performed by injecting the medicine with a very fine needle into the back of your eye. Your retinal specialist will clean your eye to prevent infection and will administer an anesthetic into your eye to reduce pain. Usually, patients receive multiple anti-VEGF injections over the course of many months. There is a small risk of complications with anti-VEGF treatment, usually resulting from the injection itself. However, for most people, the benefits of this treatment outweigh the small risk of complications.

Anti-VEGF medications are a step forward in the treatment of wet AMD because they target the underlying cause of abnormal blood vessel growth. This treatment offers new hope to those affected with wet AMD. Although not every patient benefits from anti-VEGF treatment, a large majority of patients achieve stabilized vision, and a significant percentage can improve to some degree.

Branch Retinal Artery Occlusion

Most people know that high blood pressure and other vascular diseases pose risks to overall health, but many may not know that high blood pressure can affect vision by damaging the arteries in the eye.

Branch retinal artery occlusion (BRAO) blocks the small arteries in the retina, the light-sensing nerve layer lining the back of the eye. The most common cause of BRAO is a **thrombosis**, the formation of a blood clot. Sometimes the blockage is caused by an **embolus**, a clot carried by the blood from another part of the body.

Central vision is lost suddenly if the blocked retinal artery is one that nourishes the macula, the part of the retina responsible for fine, sharp vision. Following BRAO, vision can range from normal (20/20) to being barely able to detect hand movement.

BRAO poses significant risks to vision. If you have had a branch retinal artery occlusion, regular visits to your ophthalmologist are essential.

Branch Retinal Vein Occlusion

Most people know that high blood pressure and other vascular diseases pose risks to overall health, but many may not know that high blood pressure can affect vision by damaging the veins in the eye. High blood pressure is the most common condition associated with **branch retinal vein occlusion (BRVO).** About 10% to 12% of the people who have BRVO also have **glaucoma** (high pressure in the eye).

BRVO blocks small veins in the retina, the layer of light-sensing cells at the back of the eye. If the blocked retinal veins are ones that nourish the **macula**, the part of the retina responsible for straight-ahead vision, some central vision is lost. During the course of vein occlusion, 60% or more will have swelling of the central macular area. In about one-third of people, this macular edema will last for more than one year.

BRVO causes a painless decrease in vision, resulting in misty or distorted vision. If the veins cover a large area, new abnormal vessels may grow on the retinal surface, which can bleed into the eye and cause blurred vision.

There is no cure for BRVO. Finding out what caused the blockage is the first step in treatment. Dr. Ren may recommend a period of observation, since hemorrhages and excess fluid may subside on their own. Depending on how damaged the veins are, laser surgery may help reduce the swelling and improve vision. Laser surgery may also shrink

abnormal new blood vessels that can grow and that are at risk of bleeding. Newer injectable medicines are being investigated for treating BRVO.

If you have had a branch retinal vein occlusion, regular visits to your ophthalmologist/optometrist are essential to protect vision.

Central Retinal Artery Occlusion

You probably know that high blood pressure and other vascular diseases pose risks to your overall health, but you may not know that they can affect your eyesight by damaging the arteries in your eye.

Central retinal artery occlusion (CRAO) usually occurs in people between the ages of 50 and 70. The most common medical problem associated with CRAO is **arteriosclerosis** (hardening of the arteries). Carotid artery disease is found in almost half the people with CRAO.

The most common cause of CRAO is a **thrombosis** (an abnormal blood clot formation). CRAO can also be caused by an **embolus**, a clot that breaks off from another area of the body and is carried to the retina by the bloodstream.

CRAO blocks the central artery in your retina, the light-sensitive nerve layer at the back of the eye. The first sign of CRAO is a sudden and painless loss of vision that leaves you barely able to count fingers or determine light from dark.

Loss of vision can be permanent without immediate treatment. Irreversible retinal damage occurs after 90 minutes, but even 24 hours after symptoms begin, vision can still be saved. The goal of emergency treatment is to restore retinal blood flow. After emergency treatment, you should have a thorough medical evaluation.

Central Retinal Vein Occlusion

You probably know that high blood pressure and other vascular diseases pose risks to overall health, but you may not know that they can affect eyesight by damaging the veins in the eye.

Central retinal vein occlusion (CRVO) blocks the main vein in the retina, the light-sensitive nerve layer at the back of the eye. The blockage causes the walls of the vein to leak blood and excess fluid into the retina. When this fluid collects in the **macula** (the area of the retina responsible for central vision), vision becomes blurry.

“Floaters” in your vision are another symptom of CRVO. When retinal blood vessels are not working properly, the retina grows new fragile vessels that can bleed into the

vitreous, the fluid that fills the center of the eye. Blood in the vitreous clumps and is seen as tiny dark spots, or floaters, in the field of vision.

In severe cases of CRVO, the blocked vein causes painful pressure in the eye. Retinal vein occlusions commonly occur with **glaucoma**, **diabetes**, **age-related vascular disease**, high blood pressure, and blood disorders.

The first step of treatment is finding what is causing the vein blockage. There is no cure for CRVO. Your retinal specialist may recommend a period of observation, since hemorrhages and excess fluid often subside on their own. Laser surgery may be effective in preventing further bleeding into the vitreous or for treating glaucoma, but it cannot remove a hemorrhage or cure glaucoma once it is present. New experimental treatments are now under investigation.

Central Serous Retinopathy

Central serous retinopathy (CSR) is a small, round, shallow swelling that develops on the retina, the light-sensitive nerve layer that lines the back of the eye. Although the swelling reduces or distorts vision, the effects are usually temporary. Vision generally recovers on its own within a few months.

In the initial stages of CSR, vision may suddenly become blurred and dim. If the **macula** (the area of the retina responsible for central vision) is not affected, there may be no obvious symptoms.

CSR typically affects adults between the ages of 20 and 50. People with CSR often find that their retinal swelling resolves without treatment and their original vision returns within six months of the onset of symptoms. Some people with frequent episodes may have some permanent vision loss. Recurrences are common and can affect 20% to 50% of people with CSR. While the cause of CSR is unknown, it seems to occur at times of personal or work-related stress.

As CSR usually resolves on its own, no treatment may be necessary. Sometimes laser surgery can reduce the swelling sooner, but the final visual outcome is usually about the same. If retinal swelling persists for more than three or four months, or if an examination reveals early retinal degeneration, laser surgery may be helpful.

Detached and Torn Retina

A retinal detachment is a very serious problem that usually causes blindness unless treated. The appearance of flashing lights, floating objects, or a gray curtain moving across the field of vision are all indications of a retinal detachment. If any of these occur, see an retinal specialist right away.

As one gets older, the **vitreous** (the clear, gel-like substance that fills the inside of the eye) tends to shrink slightly and take on a more watery consistency. Sometimes as the vitreous shrinks, it exerts enough force on the retina to make it tear.

Retinal tears can lead to a retinal detachment. Fluid vitreous, passing through the tear, lifts the retina off the back of the eye like wallpaper peeling off a wall. Laser surgery or cryotherapy (freezing) are often used to seal retinal tears and prevent detachment.

If the retina is detached, it must be reattached before sealing the retinal tear. There are three ways to repair retinal detachments. **Pneumatic retinopexy** involves injecting a special gas bubble into the eye that pushes on the retina to seal the tear. The **scleral buckle procedure** requires the fluid to be drained from under the retina before a flexible piece of silicone is sewn on the outer eye wall to give support to the tear while it heals. **Vitrectomy surgery** removes the vitreous gel from the eye, replacing it with a gas bubble, which is slowly replaced by the body's fluids.

Epiretinal Membrane

The retina is a layer of light-sensing cells lining the back of your eye. As light rays enter your eye, the retina converts the rays into signals that are sent through the optic nerve to your brain, where they are recognized as images.

The **macula** is the small area at the center of your retina that allows you to see fine details. The macula normally lies flat against the back of the eye, like film lining the back of a camera. As you age, the clear, gel-like substance that fills the middle of your eye begins to shrink and pull away from the retina. In some cases, a thin "scar tissue" or membrane can grow on the surface of the macula. When wrinkles, creases, or bulges form on the macula due to this scar tissue, this is known as an **epiretinal membrane** or **macular pucker**. Damage to your macula causes blurred central vision, making it difficult to perform tasks such as reading small print or threading a needle. Peripheral (side) vision is not affected.

Symptoms, which can be mild or severe and affect one or both eyes, may include:

- blurred detail vision;
- distorted or wavy vision;
- gray or cloudy area in central vision; and
- blind spot in central vision.

Your retinal specialist detects an epiretinal membrane by examination and special photographic techniques. If your symptoms are mild, no treatment may be necessary. Updating your eyeglass prescription or wearing bifocals may improve your vision sufficiently. If you have more severe symptoms that interfere with your daily routine, your ophthalmologist may recommend **vitrectomy surgery** to peel and remove the abnormal scar tissue. During this outpatient procedure, your ophthalmologist uses tiny instruments to remove the wrinkled tissue. Vision often improves.

Be sure to discuss your options with your ophthalmologist. If surgery is recommended, you should be aware that as with any surgical procedure, rare complications can occur, including infection, bleeding, retinal detachment, recurrence of the epiretinal membrane, and earlier onset of cataract.

Face-Down Recovery After Retinal Surgery

The retina is a layer of light-sensing cells lining the back of your eye. As light enters your eye, the retina converts the rays into signals that are sent through the optic nerve to your brain, where they are recognized as images.

To repair a damaged or detached retina, your ophthalmologist may remove some of your eye's **vitreous** (the gel-like substance that fills the inside of your eye) and inject a gas bubble into the eye to take its place. This bubble holds the retina in place as it re-attaches to the back of your eye. With time, the bubble disappears and is replaced with your normal eye fluid.

You must keep your head facing downward or turned to a particular side for up to several weeks after surgery so that the bubble will remain in the right position. In some cases the positioning requirements are full-time, and in others it may be part-time. If you lie in the wrong position, such as face-up, pressure may be applied to other parts of the eye, causing further problems like cataract or glaucoma. To assist you in keeping your face pointed downward, special equipment is available, including adjustable face-down chairs, tabletop face cradles, face-down pillows, and mirrors.

Floaters and Flashes

Small specks or clouds moving in your field of vision as you look at a blank wall or a clear blue sky are known as **floaters.** Most people have some floaters normally but do not notice them until they become numerous or more prominent.

In most cases, floaters are part of the natural aging process. Floaters look like cobwebs, squiggly lines, or floating bugs. They appear to be in front of the eye but are actually floating inside. As we get older, the **vitreous** (the clear, gel-like substance that fills the inside of the eye) tends to shrink slightly and detach from the retina, forming clumps within the eye. What you see are the shadows these clumps cast on the retina, the light-sensitive nerve layer lining the back of the eye.

The appearance of flashing lights comes from the traction of the vitreous gel on the retina at the time of vitreous separation. **Flashes** look like twinkles or lightning streaks. You may have experienced the same sensation if you were ever hit in the eye and "saw stars."

Floaters can get in the way of clear vision, often when reading. Try looking up and then down to move the floaters out of the way. While some floaters may remain, many of them will fade over time.

Floaters and flashes are sometimes associated with retinal tears. When the vitreous shrinks, it can pull on the retina and cause a tear. A torn retina is a serious problem. It can lead to a retinal detachment and blindness. If new floaters appear suddenly or you see sudden flashes of light, see an ophthalmologist/optometrist immediately.

Fluorescein Angiography

Fluorescein angiography, a clinical test to look at blood circulation inside the back of the eye, aids in the diagnosis of retinal conditions associated with diabetes, age-related macular degeneration, and other eye abnormalities. The test can also help follow the course of a disease and monitor its treatment. It may be repeated on multiple occasions with no harm to the eye or body.

Fluorescein is an orange-red dye that is injected into a vein in the arm. The dye travels through the body to the blood vessels in the retina, the light-sensitive nerve layer at the back of the eye. A special camera with a green filter flashes a blue light into the eye and takes multiple photographs of the retina. The technique uses regular photographic film, or, more commonly, is performed with digital equipment. No X-rays are involved.

If there are abnormal blood vessels, the dye leaks into the retina or stains the blood vessels. Damage to the lining of the retina or atypical new blood vessels may be revealed as well. These abnormalities are determined by a careful interpretation of the photographs by an retinal specialist.

The dye can discolor skin and urine until it is removed from the body by the kidneys. There is little risk in having fluorescein angiography, though some people may have mild allergic reactions to the dye. Severe allergic reactions have been reported but only very rarely. Being allergic to X-ray dyes with iodine does not mean you will be allergic to fluorescein. Occasionally, some of the dye leaks out of the vein at the injection site, causing a slight burning sensation that usually goes away quickly.

Indocyanine Green Angiography

Indocyanine green angiography (ICG) is a clinical test used to detect abnormal blood vessels in the choroid, the layer of blood vessels under the retina. These abnormal blood vessels, typically associated with **macular degeneration**, may cause bleeding, scarring, and vision loss. If the blood vessels can be restricted with treatment, vision loss may be stabilized or improved.

Indocyanine, a harmless green dye, gives off infrared light. When injected into the bloodstream, the dye travels through the veins to the blood vessels in the eye. A video camera connected to a computer picks up the infrared light and makes a picture of the blood’s circulation. No film or X-rays are involved.

Following the test, the liver removes the dye from the body. There is little risk in having an ICG angiogram. Some people may have mild allergic reactions and, although rare, a

few severe allergic reactions have been reported in people allergic to iodine, X-ray dyes, and shellfish.

Lattice Degeneration

Lattice degeneration is a condition that causes thinning and weakening of the peripheral retina, the light-sensitive layer of cells lining the back of the eye, which can lead to a retinal tear.

The **vitreous**, a clear, gel-like substance that fills the inside of the eye, is contained in a sac loosely attached to the retina. As one ages, the vitreous takes on a more fluid consistency, and the sac sometimes separates from the retina. In lattice degeneration, there are places where the sac is strongly attached to the retina and pulls on it. This pulling weakens the retina and creates "lattice" lesions, which look like white, crisscrossing lines on the retina.

If part of the vitreous sac becomes detached from the retina, the friction and pulling at the attachment site can create a tear in the retina. Lattice degeneration can sometimes cause **retinal detachments** when holes or tears in the lattice formation permit vitreous fluid to flow under the retina.

Fortunately, most people with lattice degeneration do not develop a retinal detachment. Preventive treatment of lattice degeneration is indicated in some cases, but usually, the retinal specialist will only need to monitor the condition. If you have a history of lattice degeneration, you should be aware of the symptoms of retinal tears and detachment.

Macular Degeneration and Nutritional Supplements

Age-related macular degeneration (AMD) is a disease caused by damage or breakdown of the **macula**, the small part of the eye's retina that is responsible for our central vision. This condition affects both distance and close vision and can make some activities (like threading a needle or reading) very difficult or impossible. Macular degeneration is the leading cause of severe vision loss in people over 65.

Although the exact causes of AMD are not fully understood, a recent scientific study shows that antioxidant vitamins and zinc may reduce the effects of AMD in some people with the disease.

Among people at high risk for late-stage macular degeneration (those with intermediate AMD in both eyes or advanced AMD in one eye), a dietary supplement of vitamins C, E, and beta-carotene, along with zinc, lowered the risk of the disease progressing to advanced stages by about 25% to 30%. However, the supplements did not appear to benefit people with minimal AMD or those with no evidence of macular degeneration.

Light may affect the eye by stimulating oxygen, leading to the production of highly reactive and damaging compounds called **free radicals**. Antioxidant vitamins (vitamins

C and E and beta-carotene) may work against this activated oxygen and help slow the progression of macular degeneration.

Zinc, one of the most common minerals in the body, is very concentrated in the eye, particularly in the retina and macula. Zinc is necessary for the action of over 100 enzymes, including chemical reactions in the retina. Studies show that some older people have low levels of zinc in their blood. Because zinc is important for the health of the macula, supplements of zinc in the diet may slow down the process of macular degeneration.

The levels of antioxidants and zinc shown to be effective in slowing the progression of AMD cannot be obtained through your diet alone. These vitamins and minerals are recommended in specific daily amounts as supplements to a healthy, balanced diet.

It is very important to remember that vitamin supplements are not a cure for AMD, nor will they restore vision you may have already lost from the disease. However, specific amounts of certain supplements do play a key role in helping some people at high risk for advanced AMD to maintain their vision. You should speak with your retinal specialist to determine if you are at risk for developing advanced AMD and to learn if supplements are recommended for you.

Macular Dystrophy

Macular dystrophy is a hereditary condition in which the **macula** degenerates. The macula is the part of your retina responsible for acute central vision, the vision one uses to read, watch television, and recognize faces.

Symptoms of macular dystrophy can range from minimal vision loss and disturbance of color vision to profound loss of reading and night vision. The most common types of macular dystrophies, which tend to appear early in life, are **Best's disease**, **Stargardt's macular dystrophy**, and **bull's eye maculopathy**.

Considerable research is directed toward finding the hereditary cause of many types of macular dystrophies. With further research, it may be possible to develop medical treatments to prevent or slow the progression of macular dystrophy.

Low-vision devices can help affected individuals continue with many of the activities of daily life.

Macular Edema

Macular edema is the swelling of the **macula**, the small area of the retina responsible for central vision. The edema is caused by fluid leaking from retinal blood vessels. Central vision, used for reading and other close, detail work, is affected.

Because the macula is surrounded by many tiny blood vessels, anything that affects them, such as a medical condition affecting blood vessels elsewhere in the body or an abnormal condition originating in the eye, can cause macular edema.

Retinal blood vessel obstruction, eye inflammation, and **age-related macular degeneration** have all been associated with macular edema. The macula may also be affected by swelling following cataract extraction, although typically this resolves itself naturally.

Treatment seeks to remedy the underlying cause of the edema. Eyedrops, injections of steroids or other, newer medicines in or around the eye, or laser surgery can be used to treat macular edema. Recovery depends on the severity of the condition causing the edema.

Macular Hole

The macula is the part of the retina responsible for acute central vision, the vision you use for reading, watching television, and recognizing faces. A macular hole is a small, round opening in the macula. The hole causes a blind spot or blurred area directly in the center of your vision.

Most macular holes occur in the elderly. When the **vitreous** (the gel-like substance inside the eye) ages and shrinks, it can pull on the thin tissue of the macula, causing a tear that can eventually form a small hole. Sometimes injury or long-term swelling can cause a macular hole. No specific medical problem is known to cause macular holes.

Vitrectomy surgery, the only treatment for a macular hole, removes the vitreous gel and scar tissue pulling on the macula and keeping the hole open. The eye is then filled with a special gas bubble to push against the macula and close the hole. The gas bubble will gradually dissolve, but the patient must maintain a face-down position for one to two weeks to keep the gas bubble in contact with the macula. Success of the surgery often depends on how well the position is maintained.

With treatment, most macular holes shrink, and some or most of the lost central vision can slowly return. The amount of visual improvement typically depends on the length of time the hole was present.

Myopic Degeneration

Myopic degeneration is a condition characterized by progressive stretching of the eye that damages the retina, the layer of light-sensitive cells that lines the back of the eye. People with severenearsightedness (high myopia) are at greater risk for myopic degeneration.

Myopic degeneration commonly occurs during young adulthood and can lead to a gradual decrease in central vision. Vision can decrease more abruptly in a small percentage of patients. Although central vision may be lost, side (peripheral) vision usually remains

unaffected. Remaining sight can still be very useful, and with the help of low vision optical devices, people with this condition can continue many of their normal activities.

The causes of myopic degeneration are not clearly understood, but they may include biomechanical abnormalities or hereditary factors. The biomechanical theory assumes that the retina, in a myopic eye, is stretched over a larger than normal area because the eye is longer in shape than is normal. Over time, the outer coat of the eye, known as the sclera, also stretches in response to forces like internal eye pressure. This stretching of the sclera is thought to lead to retinal degeneration. In the hereditary theory, the retinal changes are thought to be an unavoidable, inherited process.

Loss of central vision can occur if abnormal vessels grow directly under the center of the retina in an area known as the macula. This is called **choroidal neovascularization.** Early diagnosis and treatment can minimize the amount of vision loss. People with myopic degeneration should have their vision monitored by an retinal specialist on a regular basis. Using an **Amsler grid** to monitor vision at home is also helpful in detecting early growth of these abnormal vessels.

Patients with myopic degeneration have an increased risk of developing peripheral retinal tears and retinal detachment. If a patient experiences new flashes of light, "floaters," "curtains" or "veils," or loss of vision, he or she should see an ophthalmologist immediately.

Nonproliferative Diabetic Retinopathy

If you have diabetes mellitus, your body does not use and store glucose properly. Over time, diabetes can damage blood vessels in the retina, the nerve layer at the back of the eye that senses light and helps to send images to the brain. The damage to retinal vessels is referred to as diabetic retinopathy**.**

Nonproliferative diabetic retinopathy (NPDR), commonly known as background retinopathy, is an early stage of diabetic retinopathy. In this stage, tiny blood vessels within the retina leak blood or fluid. The leaking fluid causes the retina to swell or to form deposits called **exudates**.

Many people with diabetes have mild NPDR, which usually does not affect their vision. When vision is affected, it is the result of macular edema or macular ischemia, or both.

Macular edema is swelling or thickening of the macula, a small area in the center of the retina that allows us to see fine details clearly. The swelling is caused by fluid leaking from retinal blood vessels. It is the most common cause of visual loss in diabetes. Vision loss may be mild to severe, but even in the worst cases, peripheral (side) vision continues to function. Laser treatment can be used to help control vision loss from macular edema. Newer treatments are being investigated.

Macular ischemia occurs when small blood vessels (capillaries) close. Vision blurs because the macula no longer receives sufficient blood supply to function properly. Unfortunately, there are no effective treatments for macular ischemia.

A medical eye examination is the only way to discover any changes inside your eye. If your retinal specialist finds diabetic retinopathy, he or she may order color photographs of the retina, a special test called fluorescein angiography, or optical coherence tomography (OCT) to find out if you need treatment.

If you have diabetes, early detection of diabetic retinopathy is the best protection against loss of vision. You can significantly lower your risk of vision loss by maintaining strict control of your blood glucose and visiting your ophthalmologist regularly. People with diabetes should schedule examinations at least once a year. Pregnant women with diabetes should schedule an appointment in their first trimester, because retinopathy can progress quickly during pregnancy. More frequent medical eye examinations may be necessary after a diagnosis of diabetic retinopathy.

Ocular Histoplasmosis Syndrome

Ocular histoplasmosis syndrome (OHS) is a major cause of visual impairment in the eastern and central United States, where 90% of adults have been exposed to *Histoplasma capsulatum.* This common fungus is found in molds from soil enriched with bat, chicken, or starling droppings and yeasts from animals.

Although the fungus is not found directly in the eye, people with OHS usually test positive for previous exposure to *Histoplasma capsulatum*.

Histoplasmosis is usually mistaken for a cold. The symptoms are very similar. The body's immune system normally overcomes the infection in a few days. Generally, "histo spots," or small scars in the retina, do not affect vision, but for unknown reasons, some people can have ocular complications years or decades later.

Doctors believe that the histoplasmosis spores travel from the lungs to the eye where they settle in the choroid, the layer of tiny blood vessels that provide blood and nutrients to the retina, the light-sensing layer of cells lining the back of the eye.

Ocular histoplasmosis can affect vision when fragile, abnormal blood vessels grow under the retina. These abnormal blood vessels form a lesion known as a **choroidal neovascularization (CNV).** If left untreated, the CNV lesion can turn into scar tissue and replace the normal retinal tissue in the macula.

The only proven treatment for OHS is a form of laser surgery called **photocoagulation.** The laser's small, powerful beam of light destroys the abnormal blood vessels as well as a small amount of the retinal tissue. Other treatments, including steroids and intraocular injections, are sometimes used. Treatment is not necessary unless the new vessels are in the macula, the part of the retina responsible for acute central vision.

Although only a very small number of people infected with the histoplasmosis virus develop OHS, if you have been exposed to histoplasmosis, you should be sensitive to any changes in your eyesight, and you should monitor your vision using an **Amsler grid test** at home.

Photodynamic therapy (PDT)—an outpatient procedure involving the use of a special light-activated drug—is used to treat some patients with wet AMD. PDT causes fewer visual side effects than other treatments. The benefit of PDT is that it inhibits abnormal blood vessel leakage associated with wet macular degeneration, limiting damage to the overlying retina.

With PDT, the inactive form of the drug is usually injected into a vein in the arm, where it travels to and accumulates in abnormal blood vessels under the center of the macula. A special low-intensity laser light targeted at the retina activates the drug only in the affected area, damaging the abnormal blood vessels under the retina and leaving normal blood vessels intact.

Patients who are treated with PDT will become temporarily extra sensitive to bright light (photosensitive). Care should be taken to avoid exposure of the skin or eyes to direct sunlight or bright indoor light for several days.

PDT therapy is not effective for treatment of **atrophic or " dry" AMD**, which is caused by aging and thinning of the tissues of the macula. Although photodynamic therapy can preserve vision for many people, it may not stop vision loss in all patients. The abnormal blood vessels may regrow or begin to leak again. Every three months, patients must undergo a repeat examination that includes a **fluorescein angiogram** dye test. Multiple PDT treatments sometimes are necessary.

Proliferative Diabetic Retinopathy

Proliferative diabetic retinopathy (PDR) is a complication of diabetes caused by changes in the blood vessels of the eye. If you have diabetes, your body does not use and store sugar properly. High blood sugar levels create changes in the veins, arteries, and capillaries that carry blood throughout the body. This includes the tiny blood vessels in the retina, the light-sensitive nerve layer that lines the back of the eye.

In PDR, the retinal blood vessels are so damaged they close off. In response, the retina grows new, fragile blood vessels. Unfortunately, these new blood vessels are abnormal and grow on the surface of the retina, so they do not resupply the retina with blood.

Occasionally, these new blood vessels bleed and cause a **vitreous hemorrhage**. Blood in the vitreous, the clear gel-like substance that fills the inside of the eye, blocks light rays from reaching the retina. A small amount of blood will cause dark floaters, while a large hemorrhage might block all vision, leaving only light and dark perception.

The new blood vessels can also cause scar tissue to grow. The scar tissue shrinks, wrinkling and pulling on the retina and distorting vision. If the pulling is severe, the macula may detach from its normal position and cause vision loss.

Laser surgery may be used to shrink the abnormal blood vessels and reduce the risk of bleeding. The body will usually absorb blood from a vitreous hemorrhage, but that can take days, months, or even years. If the vitreous hemorrhage does not clear within a reasonable time, or if a retinal detachment is detected, an operation called a vitrectomy can be performed. During a vitrectomy, the eye surgeon removes the hemorrhage and any scar tissue that has developed, and performs laser treatment to prevent new abnormal vessel growth.

People with PDR sometimes have no symptoms until it is too late to treat them. The retina may be badly injured before there is any change in vision. There is considerable evidence to suggest that rigorous control of blood sugar decreases the chance of developing serious proliferative diabetic retinopathy.

Because PDR often has no symptoms, if you have any form of diabetes you should have your eyes examined regularly by retinal specialist.

Retinal Side Effects From Systemic Medication

The retina is a layer of light-sensing cells that line the back of the eye. As light rays enter your eye, the retina converts the rays into signals that are sent through the optic nerve to your brain, where they are recognized as images.

Certain systemic medications, which affect the entire body rather than one specific location, can sometimes affect the retina and lead to vision loss. If you are taking any of the medications below to treat other conditions, be sure to tell your retinal specialist so that your eyes can be examined frequently to check for potential damage and vision loss. Other drugs not listed can also have ocular side effects.

- hydroxychloroquine, an antimalarial drug commonly used in the treatment of systemic lupus erythematosus and rheumatoid arthritis;
- niacin, also known as nicotinic acid or vitamin B_3, used as both a vitamin supplement and a lipid-lowering agent;
- chlorpromazine (Thorazine) and thioridazine, used as antipsychotics;
- amitriptyline and imipramine, used to treat depression, sleep disorders, and neuropathic pain;
- corticosteroids, used to treat inflammatory disorders and for adrenal insufficiency;
- tamoxifen, used in treating breast cancer;
- canthaxanthine, used as an artificial tanning agent, as well as for the treatment of vitiligo and other skin conditions; and
- erectile dysfunction drugs.

Caught early, it is possible to prevent damage and perhaps even to reverse it, depending on the drug and on the particular case. It is not common for eyes to be damaged by these medications, so it is important to continue to take all medications that have been prescribed for you unless your doctor tells you to discontinue them.

Retinitis Pigmentosa

Retinitis pigmentosa (RP) describes a group of related diseases that tend to run in families and cause a slow but progressive loss of vision. RP affects the rods and cones of the retina, the light-sensitive nerve layer at the back of the eye, and results in a decline in vision in both eyes. RP usually affects both eyes equally, with severity ranging from no visual problems in some families to blindness at an early age in others. RP gets its name from the fact that one of the symptoms is a clumping of the retinal pigment that can be seen during an eye exam.

The earliest symptom of retinitis pigmentosa, usually noticed in childhood, is night blindness or difficulty with night vision. People with normal vision adjust to the dark quickly, but people with night blindness adjust very slowly or not at all. A loss of side vision, known as "tunnel vision," is also common as RP progresses. Unfortunately, the combination of night blindness and the loss of peripheral vision can be severe and can lead to legal blindness in many people.

While there is a pattern of inheritance for RP, 40% of RP patients have no known previous family history. Learning more about RP in your family can help you and your ophthalmologist predict how RP will affect you.

Usher's syndrome, a condition that causes both deafness and blindness, is a form of RP. The incidence of Usher's syndrome is difficult to determine, but surveys of patients suggest up to 10% of RP patients are deaf. The incidence of Usher's syndrome is three cases per 100,000. It is the most frequent cause of combined deafness and blindness in adults.

Considerable research is being done to find the hereditary cause of RP. As hereditary defects are discovered, it may be possible to develop treatments to prevent progression of the disease. While developments are on the horizon, particularly in the area of genetic research, there is currently no cure for retinitis pigmentosa.

Nutritional supplements may be of benefit in RP. It has been reported that vitamin A can slow the progression of RP. Large doses of vitamin A are harmful to the body, and supplements of vitamin E alone may make RP worse. Vitamin E is not harmful if taken along with vitamin A or in the presence of a normal diet. Your retinal specialist can advise you about the risks and benefits of vitamin A and about how much you can safely take.

Despite visual impairment, people with RP can maintain active and rewarding lives through the wide variety of rehabilitative services that are available today. Until there is a

cure, periodic examinations by your ophthalmologist will keep you informed of legitimate scientific discoveries as they develop.

Retinoschisis

Retinoschisis is a genetic eye disease that splits the retina, the light-sensitive layer of cells lining the back of the eye. It occurs in two forms, one affecting young children, the other affecting older adults. Both forms usually affect both eyes, though one eye may be worse than the other.

Because the disease is inherited on the X chromosome, childhood retinoschisis occurs in boys more than girls. It is usually detected because of poor vision.

Retinoschisis has different affects on the eye and vision depending on the location of the split. If the split retina involves the peripheral (side) retina, peripheral vision is lost. Retinal detachment is another risk associated with retinoschisis. More commonly, retinoschisis affects the **macula**, the area of the retina responsible for central vision. If the split retina is in this location, one loses central vision.

Peripheral retinoschisis is more common in adults and is usually caused by aging. In this case, it usually does not affect vision, but it can cause a retinal detachment. If detected early, a retinal detachment can be treated with surgery or laser therapy.

Uveitis

The uvea is the middle layer in the eye sandwiched between the retina (innermost layer) and the sclera (outermost layer). The uvea contains many blood vessels that carry blood to and from the eye. Uveitis is inflammation of the uvea. Since the uvea nourishes many important parts of the eye, uveitis can damage your sight.

Symptoms can include pain, “floaters,” blurriness, light sensitivity, and redness. Uveitis may develop suddenly with redness and pain or with just a blurring of vision.

Causes of this condition include viruses like mumps, shingles, or herpes simplex; eye injuries; fungi or parasites; autoimmune diseases; and others. In most cases, the cause is unknown.

Uveitis is diagnosed by an examination of the eye. In addition, your retinal specialist may order blood tests, skin tests, or x-rays and also will want information about your overall health.

There are different types of uveitis:

Iritis
With iritis, the uvea is inflamed near the front of the eye in the iris. Iritis has a sudden onset and may last up to eight weeks.

Cyclitis
Cyclitis affects the muscle that focuses the lens in the middle part of the eye. It develops suddenly and lasts for several months.

Choroiditis
This is an inflammation in the back of the eye. It can develop more slowly than the other forms of uveitis and last longer, although this is variable.

Because uveitis is a serious condition that can cause permanent damage to the eye, it needs to be treated as soon as possible. Eyedrops and pupil dilators reduce inflammation and pain. For more severe inflammation, oral medications or injections may be necessary. If uveitis is associated with other conditions like glaucoma or retinal damage, surgery may be required.

If you have a "red eye" that does not clear up quickly, ocular pain, or other significant symptoms, see your ophthalmologist as soon as possible.

Vitrectomy Surgery

Vitrectomy is a type of eye surgery used to treat disorders of the retina (the light-sensing cells at the back of the eye) and vitreous (the clear gel-like substance inside the eye). It may be used to treat a severe eye injury, diabetic retinopathy, retinal detachments, macular pucker (wrinkling of the retina), and macular holes.

During a vitrectomy operation, the surgeon makes tiny incisions in the sclera (the white part of the eye). Using a microscope to look inside the eye and microsurgical instruments, the surgeon removes the vitreous and repairs the retina through these tiny incisions. Repairs include removing scar tissue or a foreign object if present.

During the procedure, the retina may be treated with a laser to reduce future bleeding or to fix a tear in the retina. An air or gas bubble that slowly disappears on its own may be placed in the eye to help the retina remain in its proper position, or a special fluid that is later removed may be injected into the vitreous cavity.

Recovering from vitrectomy surgery may be uncomfortable, but the procedure often improves or stabilizes vision. Once the blood- or debris-clouded vitreous is removed and replaced with a clear medium (often a saltwater solution), light rays can once again focus on the retina. Vision after surgery depends on how damaged the retina was before surgery.

Legal Blindness

Normal vision, or 20/20 vision, means that a person can read the smallest letters or see the pictures on an eye chart when standing 20 feet away from the chart. Some people cannot see normally even with eyeglasses or contacts because a medical condition affects their vision. These people are called visually impaired or visually disabled.

If a visual impairment limits vision to 20/200, or one-tenth of normal vision, a person is considered **legally blind.** Being legally blind, however, does not mean a person is totally unable to see. People with 20/20 vision but less than 20 degrees of side (peripheral) vision can also qualify as legally blind. People who see well with only one eye are not considered legally blind, nor are people who wear glasses to see better than 20/200.

Most legally blind people function quite well, especially if they have been visually impaired since childhood. Older children and adults with visual impairments may need magnifying lenses for reading and telescopes for distance viewing. People with very poor vision may need to learn Braille and walk with a seeing-eye dog or a cane.

Young children with visual disabilities should have help from a teacher of the visually impaired and should be evaluated for developmental problems by professionals experienced with visual impairments. Parents may need to be advocates for their children to obtain needed services through the school system.

Visually impaired people of all ages benefit from social service, occupational therapy, and orientation and mobility training. Many new devices are available to help them cope with vision loss, including books on audiotape, scanners that can turn print into Braille, watches that can be "read" with the fingers, and "talking" computers and calculators.

Living with Low Vision

Low vision is loss of eyesight that makes everyday tasks like reading, writing, crossing the street, or watching television difficult. When vision cannot be improved with eyeglasses, medicine, or surgery, people with low vision need to know how to best maintain their existing vision and best utilize the vision they still have.

Low vision can affect central or peripheral vision, depth of perception, or visual processing.

Low vision may be caused by eye injuries or conditions such as age-related macular degeneration, glaucoma, diabetic retinopathy, or retinitis pigmentosa.

Vision rehabilitation can help people with low vision. You can learn new strategies to complete daily activities, regaining confidence in your ability to live independently despite vision loss.

There are many low vision aids available, such as magnifying spectacles, hand and video magnifiers, and telescopes, that can help you make the most of your remaining vision. Learning to adjust lighting appropriately can often improve your vision for reading, cooking, dressing, and walking up and down stairs.

What can you do to prevent vision loss?
Early examinations can help reduce the risk of vision loss. If you are experiencing difficulty seeing, it is very important to visit your retinal specialist immediately to get a

comprehensive examination. Diagnosis and possible treatment of your eye condition may slow progression of the vision loss and in some cases can improve vision.

A low vision examination may also be helpful. Rehabilitation may be possible. A low vision examination differs from a normal eye exam in that it is typically longer and involves a number of tests that you may not be familiar with.

Typically, the ophthalmologist reviews your medical and ocular history and then asks you for detailed information about your vision problems and how they are affecting your everyday life.

After taking your history, your ophthalmologist will do a number of tests to assess your vision. These tests may include:

- refraction to assess your vision and determine if glasses may be of any use;
- dilated internal examination of the eye;
- visual field testing of your peripheral vision;
- ocular function testing for depth perception, color perception, and contrast sensitivity;
- ocular motility testing to determine how well your eyes move; and
- evaluation and trial of many different low vision devices, such as magnifiers, improved lighting, closed-circuit TVs, and electronic devices.

Having frequent eye examinations helps to ensure that your eyes will remain as healthy as possible. If you are experiencing difficulty with your vision, it is important to see your ophthalmologist right away. A comprehensive eye examination can catch eye-related problems early and help reduce vision loss.

Resources
Remember, you are not alone, and you deserve access to the information and tools you need to make the most of your sight. For more information about low vision, vision rehabilitation, and low vision aids, use these resources:

American Academy of Ophthalmology Web site
www.aao.org/aao/patient_ed/smartsight.cfm

American Foundation for the Blind
11 Penn Plaza, Suite 300
New York, NY 10001
800.232.5463
www.afb.org

Lighthouse International
111 East 59 th Street
New York, NY 10022

800.829.0500
www.lighthouse.org

National Association for Visually Handicapped
22 West 21 st Street, 6 th Floor
New York, NY 10010
212.889.3141
www.navh.org

National Library Service for the Blind and Physically Handicapped
Library of Congress
1291 Taylor Street, NW
Washington, DC 20011
800.424.8567
www.loc.gov/nls

Vision Connection
800.829.0500
www.visionconnection.org
In the "Help Near You" section, search under both "low vision services" and "vision rehabilitation."

Preventing Eye Injuries

Any activity where something might fly at the eye puts the eye at risk for an injury. Over one million people suffer eye injuries each year in the United States. Almost 50% of these accidents occur at home, and more than 90% of them could have been prevented.

Minor injuries to the cornea, the clear, protective covering over the front of the eye, can be quite painful. A corneal abrasion is a scratch to the cornea. Appropriate treatment may include an antibiotic eyedrop or ointment to prevent infection and an eye patch for comfort. Sand or other particles can stick to the cornea. Such foreign bodies may be removed with a moistened cotton swab, usually by a doctor. Do not rub the eye.

Regular prescription eyeglasses or contact lenses do not protect the eyes from injury. Some glasses and some types of contact lenses shatter if the eye is hit. People who play sports and wear prescription eyeglasses can have special safety glasses or prescription goggles made of high-impact polycarbonate plastic lenses and special unbreakable frames.

Unfortunately, many people do not think they are at risk for an eye injury until the injury occurs. The majority of eye injuries are easily prevented. Use common sense to reduce the risk of injuries, and be sure to follow safety precautions, including the following:

- Wear safety goggles when using powerful chemicals. Goggles should fit properly to prevent chemicals from getting under them yet still allow air to circulate between the eye and the lens.
- Polycarbonate sports goggles are recommended for all participants of high-impact sports or activities where there is a high risk of eye injury.
- Never use fireworks. Attend public fireworks displays instead of having fireworks at home. Amateur backyard displays are dangerous to the person lighting the fireworks, nearby family members, friends, neighbors, and pets.
- Supervise children when they are handling potentially dangerous objects, such as pencils, scissors, and penknives. Be aware that even common household items such as paper clips, elastic cords, wire coat hangers, rubber bands, and fishhooks can cause a serious eye injury.
- Avoid projectile toys such as darts and bows and arrows. Do not allow children to play with air-powered rifles, pellet guns, and BB guns. They are extremely dangerous and have been reclassified as firearms and removed from toy departments.
- Wear eye protection while mowing the lawn or using a "weed eater." Stones and debris thrown from moving blades can cause severe eye injuries.
- Always check to make sure that a spray nozzle is pointed away from your face before using.
- Use grease shields to cover frying pans and protect eyes from splattering liquids.
- Wear snug-fitting, completely opaque eyeglasses or goggles to shield your eyes and block all UV light in tanning booths. Tanning facilities are required by the U.S. Food and Drug Administration (FDA) to provide safety goggles, but it is best to obtain your own pair so you will always be prepared. If you use the salon's goggles, be sure that the salon personnel sterilize them after each use to prevent infection and that the goggles are approved for this particular use.
- Read instructions and safety warnings carefully before using tools, chemicals, ammonia, cleaning supplies, and so on.
- Wear safety goggles and be sure you read the instructions carefully before jump-starting a car. Attach the negative ground of the dead battery last. This cable should be attached to the engine away from the dead battery terminal. *Never attach a cable to the negative terminal of the dead battery***.**
- Never use a match or lighter to look under the hood of a car.

When an eye injury does occur, have an ophthalmologist/optometrist or other medical doctor examine the eye as soon as possible. Although the injury may not look or feel serious, it could cause serious damage to your eyes. If you have blurred vision, partial loss of vision, double vision, or sharp pains in your eye after an accident, see an ophthalmologist or go to a hospital emergency room right away.