

COMMON EYE DISEASES

Abstract

Diseases of the eye are a common medical condition. Vision slowly changes when people age. Aging is associated with serious eye diseases such as cataracts, diabetic retinopathy, glaucoma, and macular degeneration. These eye diseases can significantly impair a person's vision, cause blindness, and/or interfere with the activities of daily living. These eye diseases are relatively common and have an effect on vision and the ability of a patient to perform self-care. A basic understanding of common eye diseases and how they affect vision, as well as an overview of how to assist someone with impaired vision are discussed.

Learning Objectives:

1. Identify the common eye diseases and how they affect vision.
2. Describe the two forms of macular degeneration.
3. Describe the purpose of the Snellen test.
4. Describe how age-related macular degeneration is diagnosed
5. Define the use of the Amster Grid.

Introduction

Diseases of the eye are a common medical condition. When assisting an elderly population, it is very likely that some of these patients will have one or more ocular diseases. Vision slowly changes when people age. There are some eye problems that are almost an inevitable part of growing old, such as dry eyes, floaters (tiny spots that seem to “float” across the field of vision when someone is exposed to bright lights), and presbyopia, a medical term that means an inability to see object or fine print at close range. These problems are inconvenient but they are not dangerous and they can be managed. However, aging is also associated with serious eye diseases such as cataracts, diabetic retinopathy, glaucoma, and macular degeneration. These eye diseases can significantly impair a person's vision, cause blindness, and interfere with the activities of daily living. These eye diseases are relatively common and they have an effect on vision and the ability of a patient to perform self-care. The following sections provide a basic understanding of cataracts, diabetic retinopathy, glaucoma, and macular degeneration and how they affect vision, as well as an overview on how to assist someone with impaired vision.

The Basics of Vision

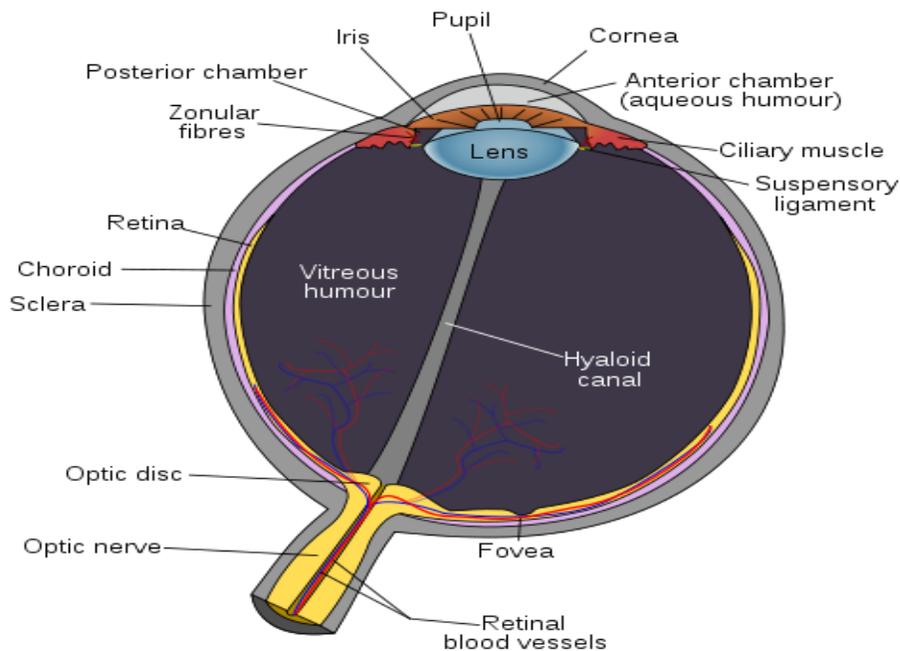
The eyes work by taking in visual data from the world and sending this information to a specific part of the brain. The process starts when a person focuses on an image or an object in the environment. These images or objects are transmitted to the eyes in the form of light rays. The light rays pass through several focusing structures in the eye and are then sent to the brain. It is the function of these structures that enable people to see objects.

The first of these structures is the cornea. The cornea is a clear membrane that covers the surface of the eye. It has five separate layers. One purpose of the cornea is to "seal" the eye and keep dirt, bacteria, and other foreign matter from entering the interior part of the eye. The other purpose of the cornea and the one that is related to eyesight is the cornea's ability to focus and control the amount of light rays that enter the eye.

The second structure that light rays must pass through is the pupil. The pupil is the dark spot in the middle of the eyeball. The pupil is not itself technically a structure. It is actually a hole or aperture in the middle of the iris. The iris is the colored or pigmented part of the eye. It is a thin, circular structure that has muscles that expand and contract. When these muscles expand and contract the pupil, the hole in the center of the iris, gets larger or smaller. The purpose of the pupil is to control the amount of light that enters the eye. The movement of the pupil can easily be seen when the amount of light changes abruptly; if a person walks into a dark room, the pupils get bigger to allow more light in, and if a person looks at a bright light, the pupils get smaller to limit the amount of light entering the eye.

The pupil is not a structure, it is simply a hole in the iris that expands and contracts to let in or keep out light. The pupil looks dark but what the person is actually seeing is the light being absorbed by the inner eye.

The following illustration shows the various basic structures of the eye.



After light rays pass through the pupil they then pass through the lens. The lens is another structure like the cornea that controls and focuses the light rays. Once the light rays have passed through the cornea and the lens, they are focused on a structure located at the back of the eye called the retina.

The retina has literally millions of light-sensing nerve cells. A specialized group of cells in the center of the retina is called the macula. The macula is designed to provide central vision with high acuity. Damage to the macula is one of the leading causes of vision loss.

These retinal cells change the light rays into electrical impulses. The optic nerve sends these electrical impulses and the visual information

to the brain, and a special part of the brain registers these impulses as vision.

The white part of the eye that surrounds the iris is called the sclera. The sclera is covered by a thin, transparent membrane called the conjunctiva. The eye also contains tear ducts. These are small openings, located in the corner of the eye near the nose. Tears are produced by the lachrymal glands, also known as the tear glands, when a person experiences strong emotions. The tears also keep the surface of the eye moist and lubricated.

The eye itself is a hollow globe and it is filled with a liquid called the vitreous humor. The vitreous humor gives the eyeball shape and structure and it also holds the retina in place at the back of the eye. The eye also contains another fluid, the aqueous humor; this is located in the anterior chamber, the space between the lens and the cornea. The aqueous humor and the vitreous humor help maintain the shape and structure of the eye. All of these parts of the eye are important to know about, but they do not contribute directly to the process of vision.

Cataracts

A cataract is an abnormality of the lens. Cataracts cause the lens to become thick, rigid and much less transparent. Cataracts can form in one or both eyes and can also form in different parts of the lens. In some people a cataract can be obvious; when a person looks directly at the eye, he or she will notice that it has a cloudy or "milky" appearance.

Cataracts are common. There are approximately 22 million Americans over the age of 40 who have a cataract and approximately 3 million Americans have cataract surgery every year. Cataracts are the leading cause of blindness worldwide. Cataracts become more common as people age and women seem to be affected more than men. There does not appear to be an ethnic risk factor for cataracts.

Blindness can be defined in several ways but in the United States blindness is defined as a visual acuity of 20/200. Visual acuity is defined as clarity or clearness of vision. Visual acuity of 20/200 means that someone who is legally blind can see at 20 feet whereas someone who has normal vision can see at 200 feet. No one knows exactly why cataracts form. Normal aging causes the lens to become rigid and less transparent but cataracts probably result from a combination of the aging process and other factors.

Cataract Risk Factors

Cataract risk factors include diabetes, excessive exposure to sunlight, family history of cataracts, high blood pressures, human immunodeficiency virus (HIV) infection, metabolic syndrome, sedentary lifestyle, smoking, and trauma. Chronic use of corticosteroids and/or statins are another risk factor of cataracts. Corticosteroids are medications such as prednisone that are used to treat conditions such as asthma and arthritis. Statins like atorvastatin (lipitor) are used to lower blood cholesterol.

Signs and Symptoms

The signs and symptoms of cataracts differ from person to person, but most people with cataracts will say that their vision is cloudy or blurred. They also cannot see well at night, and/or their eyes are very

sensitive to bright lights. Glare is a common symptom of cataracts. The lens is responsible for controlling and focusing the light rays as they enter the eye. If the lens cannot control the amount of light that enters, poor night vision and sensitivity to light occur. If the lens cannot focus the light directly onto the retina, any objects that are looked at will be blurred and indistinct.

Diagnosis of Cataracts

Cataracts can affect one eye or both eyes. Vision becomes blurred and cloudy but cataracts do not cause pain. The condition is progressive and the progression is variable from person to person. The presence of cataracts should be suspected in anyone who has a prolonged and progressive decline in visual acuity. Cataracts slowly worsen and as they do the person's visual ability worsens as well. Because cataracts are painless, it can be easy to ignore or dismiss the gradual worsening of visual acuity and ignore symptoms such as blurred vision or glare.

Snellen Eye Chart

The diagnosis of cataracts is made by performing a visual acuity test and by examining the patient's eyes with specialized ophthalmic instruments. A visual acuity test is a common diagnostic and screening procedure. It is also used for other purposes such as checking vision prior to issuance of a driver's license. It is performed using the Snellen eye chart. The patient stands at 20 feet from the eye chart, covers first one eye and then the other and is asked to read the letters on the chart, starting at the top row and progressing toward the bottom.

Snellen Eye Chart

E	1	20/200
F P	2	20/100
T O Z	3	20/70
L P E D	4	20/50
P E C F D	5	20/40
E D F C Z P	6	20/30
F E L O P Z D	7	20/25
D E F P O T E C	8	20/20
L E F O D P C T	9	
F D P L T C E O	10	
P E Z O L C F T D	11	

Treatment of Cataracts

There are no therapies that have been proven to be effective for preventing cataracts. However, smoking cessation, exercise, and supplementing the diet with extra amounts of vitamins A, C, and E may be helpful in this regard but the efficacy of these interventions have not been proven.

The treatment for cataracts is surgical removal of the an affected lens and insertion of an artificial lens. There is no immediate or urgent need to perform cataract surgery. Cataract surgery is not an emergency procedure and it can be postponed if a patient's vision can be corrected using eyeglasses. As long as a person can perform activities of daily living such as cooking, driving, and working, then the surgery does not need to be done immediately. For the majority of patients, the operation is successful, and their vision is greatly improved.

Cataract surgery is a simple procedure that is done on an outpatient basis. Cataract surgery is safe and effective. In some cases, both eyes are done at the same time but for the convenience of the patient, the operations are often done several weeks apart. The operation usually takes less than an hour and the patient returns home the same day. Extensive preoperative preparation is not needed but if the patient has hypertension the blood pressure should be reduced to a normal level before surgery.

In cataract surgery, the physician injects a local anesthesia and the patient is given some sedating medication. A small incision is made in the eye, the affected lens is removed, and an artificial lens is inserted. The lens can be physically removed with surgical tools or removed by inserting a tiny probe through the incision. The latter procedure is more common and it is done using ultrasound waves. Ultrasound waves are used to break up the lens and then the pieces of the lens are suctioned out.

Typical post-operative complaints are itching and a mild degree of discomfort, serious complications are rare. After the surgery the

patient is given anti-inflammatory eye drops to use and sometimes will need to wear an eye patch. Most patients will need to wear glasses after cataract surgery in order to restore their vision to normal.

A secondary cataract can develop after surgery. This complication is called posterior capsule opacification. This condition is easily treated with a simple procedure that can be done in the physician's office.

Glaucoma

Glaucoma is a common eye disease. It is the second leading cause of blindness worldwide. There are actually several different types of glaucoma but most cases of glaucoma are open-angle glaucoma. Open angle glaucoma is caused by increased pressure inside the eye due to a slow, gradual buildup of the aqueous humor. Normally, aqueous humor is continuously circulated through the eye and it is drained out of the eye through small ducts. However, when someone has glaucoma the aqueous humor is not drained completely or it drains too slowly. The aqueous humor accumulates and the increased pressure in the eye damages the optic nerve.

Closed angle glaucoma is much less common than open-angle glaucoma but it is much more serious. In closed angle glaucoma there is a sudden, acute blockage of the aqueous humor and closed angle glaucoma is considered to be a medical emergency.

It is not clear why glaucoma happens. Some people are born with a predisposition to the disease; the drainage channels in the eye may be abnormally small or the optic nerve may be unusually sensitive. There

are also risk factors that increase someone's chances of developing glaucoma.

Risk Factors for Glaucoma

Risk factors for glaucoma include age, ethnicity, and family history are the most important of these risk factors. The incidence of glaucoma increases with advancing age. The disease is more common in African Americans, Hispanic Americans, and Asian Americans than in white Americans, and if one of a person's parents or siblings has glaucoma there is a 2-3 times greater risk for developing the disease than someone who does not have a family history of the disease.

Glaucoma Risk Factors

Age: People age 60 have an increased risk for developing glaucoma.
Ethnicity: African-Americans, Hispanic-Americans, and Asian-Americans are more likely to develop glaucoma than Caucasians.
Diabetes
Hypertension Hypothyroidism
Eye injuries and eye infections
Nearsightedness
Family history of glaucoma

Unfortunately, many people can have glaucoma for years but they will not have any signs and symptoms until significant damage has been done to the optic nerve. Glaucoma is a progressive disease but it is not clear what factors, if any, influence the progression of glaucoma.

Glaucoma is diagnosed by examination. The physician will measure the pressure inside the eye (intraocular pressure, or IOP), exam the eyes with an ophthalmoscope, or by fundal photography with an ocular camera and check the patient's visual acuity. The ophthalmoscope and the ocular camera provide the physician with the ability to directly

examine the optic nerve and the blood vessels supplying the nerve. These tools are considered to be more useful than the measurement of IOP for diagnosing glaucoma.

Physicians and other healthcare professionals will often refer to the examination they perform with an ophthalmoscope as a fundoscopic exam. Fundus is a term that refers to the interior of the eye. The fundoscopic exam is used to assess the condition of the optic nerve, the blood vessels inside the eye, the retina, and other structures. Prior to the exam drops that dilate the pupil are placed into the eye, allowing the examiner to more easily view the retina, blood vessels, and other structures of the interior eye.

Although there is some controversy over who should be screened for glaucoma and when, the American Academy of Ophthalmology recommends that everyone over age 40 should have a comprehensive eye examination by an ophthalmologist or an appropriately trained and experienced optometrist. The examination should be repeated 3 to 5 years if the patient does not have risk factors and every 2 years if the patient has one or more risk factors.

African American men and women should begin to have these examinations beginning at age 20. After age 60, it is recommended that a comprehensive eye examination be done every 1-2 years.

If glaucoma is left untreated it can cause serious, permanent damage to the vision or blindness. There is no cure for glaucoma. However, the progression of glaucoma can be slowed and eye damage can be

prevented with timely use of therapy and there are three options for treatment - medication, laser surgery, and non-laser surgery.

Medications:

Topical eye medications such as latanoprost (Xalatan) or timolol (Timoptic) are the first-line choice for treating glaucoma. Other drugs can be used or added to the therapy protocol as needed.

Laser Surgery:

Laser therapy for the treatment of glaucoma involves a procedure called trabeculoplasty. After applying a local anesthetic to the eye the ophthalmic surgeon will use a laser to open the blocked ducts that are preventing drainage of the aqueous humor. Trabeculoplasty should be effective at maintaining a lower IOP for about 1-5 years.

Some patients who have had a successful trabeculoplasty may still need to take medications and in some cases the procedure can be repeated if necessary.

Surgery:

If medications and laser surgery are not effective then a surgical procedure that opens blocked ducts can be performed or a stent can be inserted. A stent is a tube that can be placed in an anatomical duct or a blood vessel in order to provide normal flow of body fluids or blood.

Diabetic Retinopathy

Diabetes is one of the most widespread diseases in the United States and diabetic retinopathy is a common complication of both type I (insulin-dependent) and type II (non-insulin dependent) diabetes. Approximately 95% of people with type I diabetes and 60% of people with type II diabetes will have evidence of diabetic retinopathy within 15 years of when they develop diabetes, and diabetes is the most frequent cause of blindness in adults in the United States.

The exact cause of diabetic retinopathy is not known but it is probably a direct result of a high blood sugar level that persists for years. The elevated blood sugar damages the blood vessels that supply oxygen and nutrients to the retina. These blood vessels in the retina become weakened and scarred from years of hyperglycemia. Once this happens, the blood vessels "leak" and pressure builds up in the eye. If this continues, the retina is damaged and the person's vision is permanently affected.

Unfortunately, diabetic retinopathy is similar to glaucoma. People with diabetic retinopathy usually do not have any problems with their vision until the retina has been seriously affected. Once the condition has become advanced some of these signs and symptoms may be present. Signs and symptoms of diabetic retinopathy include decreased visual acuity, poor night vision, blurred vision, difficulty reading, and spots in the visual field (floaters).

People with type I diabetes and people with type II diabetes are both at risk for developing diabetic retinopathy and the longer someone has diabetes and the higher the blood sugar the more likely it is that he or she will develop this disease. High blood pressure also increases the

risk for diabetic retinopathy and many people with diabetes have hypertension as well.

Fortunately, diabetic retinopathy can be prevented and the progression of this complication can be slowed with screening and treatment. Prevention involves maintaining good control of blood sugar and keeping the blood pressure within the desired range; it is recommended that the hemoglobin A1c (a test that determines the average blood sugar concentrations over 2-3 months) be maintained at \leq 7 percent. Lowering blood lipids may be helpful as well.

Screening has been shown to be a very effective way of reducing the incidence of vision problems caused by diabetic retinopathy. Since patients who have diabetic retinopathy do not have any symptoms until retinal damage is severe. Once this occurs, treatment may not be effective and screening is crucially important. Patients who have type 1 diabetes should be screened for diabetic retinopathy 5 years after they have developed the disease, and patients who have type 2 diabetes should be screened for diabetic retinopathy at the time they are diagnosed with diabetes. The preferred test for screening is an ophthalmoscopic examination by an experienced ophthalmic physician or an optometrist. Fundal photography can also be used.

Diabetic retinopathy damages the blood vessels in the eyes. There is also a type of diabetic retinopathy that causes new blood vessels to develop in response to the original damage; this is called proliferative diabetic retinopathy. Unfortunately, these new blood vessels themselves are weak and prone to bleeding and scarring. If the blood sugar and blood pressure cannot be controlled and if diabetic

retinopathy has already begun to develop it can be treated with medications, surgery or a procedure called laser photocoagulation.

Unless they have complications, people who have a mild degree of diabetic retinopathy are usually not treated but instead are followed very closely with periodic ophthalmic exams.

Medications:

Medications that injected directly into the eye - intravitreal injections - are used to slow the growth of new blood vessels that may increase the damage caused by diabetic retinopathy. These drugs are called vascular endothelial growth factor (VEGF) medications and they may be used in conjunction with photocoagulation therapy.

Photocoagulation Therapy:

Photocoagulation therapy is the first choice treatment for people who have significant diabetic retinopathy. Photocoagulation uses a laser beam to patch or remove the leaking blood vessels in the retina that are a result of diabetic retinopathy. This therapy has been shown to significantly slow the progression of diabetic retinopathy, but one of the side effects of the procedure is a loss of peripheral vision; this is considered to be an acceptable risk when compared with the more serious loss of vision caused by progressing diabetic retinopathy.

Vitrectomy:

Vitrectomy is a surgical procedure that removes vitreous humor from the eye. It may be done alone or in conjunction with photocoagulation

therapy and it is typically reserved for patients who have severe diabetic retinopathy.

Medications, surgery, and laser photocoagulation can treat the symptoms of diabetic retinopathy and help prevent further damage. However, diabetic retinopathy is a complication of diabetes, there is no cure for diabetes, and diabetic retinopathy can reoccur. Controlling blood sugar and controlling hypertension are lifelong processes.

Macular Degeneration

Age-related macular degeneration is the leading cause of severe vision loss in people over age 60. Macular degeneration does not often cause blindness but because people who have macular degeneration lose central, direct vision, which is defined as the ability to see objects directly in front of them, people who have this disease can be severely limited in their daily activities and are susceptible to accidents and falls.

There is no single cause of age-related macular degeneration. Age, genetics, environmental issues, family history of the disease, and medical conditions such as atherosclerosis, diabetes, female gender, high cholesterol, hypertension, obesity, smoking, and sun exposure are risk factors that increase the susceptibility to age-related macular degeneration.

There are two forms of age-related macular degeneration, *dry* and *wet*. The dry form is much more common and vision loss in this type of macular degeneration is slow and progressive, taking place over a period of years. The wet form of the disease is much less common but

more serious; vision loss develops relatively quickly over a period of weeks or months.

Identifying age-related macular degeneration is challenging because like with the other eye diseases discussed in these sections, there are no signs and symptoms of age-related macular degeneration until there is significant damage to the eye. Some patients may report a dark blur in the center of their vision or problems with color perception but typically age-related macular degeneration is discovered by examination.

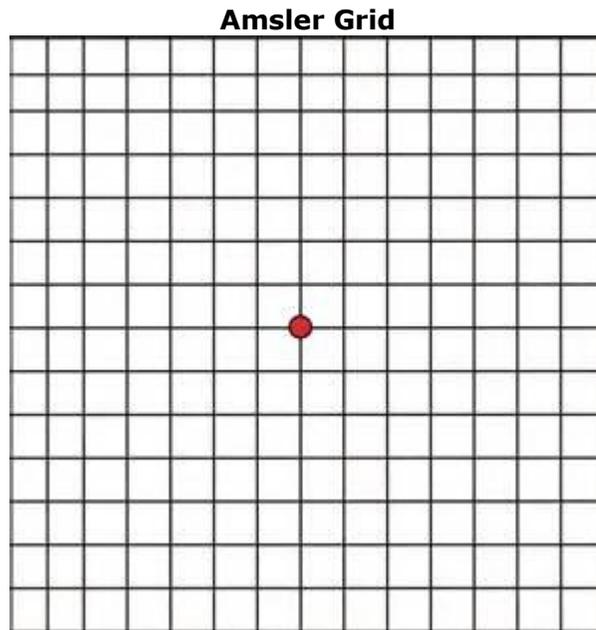
Age-related macular degeneration is diagnosed by a fundoscopic examination, perhaps in combination with a visual acuity test and other diagnostic tools. It can also be diagnosed by using angiography, a procedure by which a dye is injected into the blood vessels of the eye and the eye is then examined with a special camera. The Amsler grid (illustrated below) can also be useful and some physicians will provide patients with a copy of the grid and instruction for its use, allowing the patients to do at-home monitoring of their vision.

Screening is important because of the asymptomatic nature of age-related macular degeneration and because treatment can slow progression of the disease and decrease the degree of vision loss.

Instructions for the Amsler Grid:

The person is asked to wear their glasses and place the chart 14 inches from the face. One eye is covered and the person is asked to stare at the red dot in the center of the grid. If any of the straight lines appear bent or wavy, the boxes appear to be of different sizes or

shapes from the others, or if any of the lines are blurry, discolored, or missing, the person should seek medical help immediately.



Treatment can reverse damage caused by age-related macular degeneration, and lifestyle changes such as smoking cessation, supplementing the diet with extra amounts of vitamins A, C, and E and the minerals copper and zinc may help to slow its progression. Specific treatments for age-related macular degeneration include the VEGF drugs, standard laser therapy, photodynamic laser therapy (PDL), and surgery to remove damaged blood vessels in the macula. These therapies can slow the progression of age-related macular degeneration and improve visual acuity.

Assisting the Patient with Impaired Vision

When a Certified Nursing Assistant (CNA) works with a patient who has impaired vision, the focus should be on helping the patient

maintain independence, and on patient safety. A patient can often say exactly what limitations exist and what he or she is capable of doing. However, as a member of the interdisciplinary health team, a CNA has a responsibility to make sure that the patients the CNA is caring for are free from harm. This involves a balance between helping a patient do as much self-care as can be done within the patient's limits. The CNA must determine what the patient can or cannot do, make sure the environment is safe, and assist the patient when needed to help with activities of daily living. The CNA's assessment of the patient's abilities and limitations and the safety of the environment are very important.

Determining the Patient's Ability

The CNA does not have to perform a complicated assessment of someone's vision but may quickly determine whether or not someone has the visual ability needed to be independent. This would involve having the patient answer questions related to whether the patient can recognize the CNA when he or she is entering a room or only after the CNA is standing right in front of the patient. If the patient is reading printed material, it's important to note whether he or she complains that the print is too small or always has to ask someone else to read. Does the patient have to sit very close to the television set? Is the patient only comfortable if a room is very well lit? Most importantly, the CNA should determine whether the patient's vision is a limiting factor in performing activities of daily living, providing self-care, or being safe in the environment?

Although many older adults can see well, many do have vision problems and the risk of developing cataracts, diabetic retinopathy, or glaucoma definitely increases with age so when a CNA is working with

older patients, they must keep in mind that their visual ability may be lacking. Losing visual ability is upsetting and it represents a possible loss of independence. When working with someone who may have impaired vision, a CNA should enquire about how well the person can see to perform the activities of daily living, and whether visual loss is a safety issue.

The loss of visual ability is often gradual. People slowly become adjusted to their decreased ability to see. They develop the ability to compensate, they do not notice the changes, or they may deny that their visual acuity has decreased. People are often "surprised" to know that their vision is not what it used to be. Patients may know they cannot see as well as they once did, they may not know, or they may know their vision is poor and deny the fact, but the CNA should have a clear idea about how well the patient can see.

Making an Environment Safe

Making the environment safe for someone who has impaired vision is simple. Make sure it is organized in a predictable way, make sure it is well lit, and make sure that any obvious hazards are removed.

Predictable organization of the environment (such as, always having objects in the same place) has obvious benefits. For example, many patients depend on having their medications and personal care products stored in a certain order, and this can be helpful. They also depend on having furniture kept in order, and other daily habits like having their house keys always kept in the same place.

Keeping the environment well lit is important because people with impaired vision can see better if there are no shadows and there is

adequate light. Obvious hazards such as loose rugs, electrical cords that run across open spaces, furniture that sticks out into the room, and walkways or aisles with objects in them need to be corrected.

Assisting the Visually Impaired

There are some simple rules that a CNA can use to help a person who has less than optimal vision. First, do not assume that every older adult cannot see well. Second, always ask before offering help. Third, when helping someone whose vision is impaired a CNA must communicate with the patient. The CNA may ask the patient what he or she needs and tell the patient what is being done. For example, when working with an older adult who may have impaired vision and who is getting dressed, the CNA may ask that person if he or she needs help finding clothing and getting dressed. If the answer is yes, the CNA needs to be clear about what he or she is going to do and when; for example, letting the patient know "I'm going to place your arm through the sleeve of your sweater now." The CNA should give the patients the help they need, not what is assumed that they need. The simplest way to do this is to ask a patient what specific activities or tasks that require some help. However, a CNA must also be observant and trust his or her own professional judgment; if a situation is clearly unsafe, the CNA needs to intervene and speak up.

Summary

Disease of the eyes are significantly affected by advanced age and older people are at increased risk for developing cataracts, diabetic retinopathy, glaucoma, and age-related macular degeneration. Ocular diseases are chronic and progressive, and unfortunately most patients will not notice a change in their vision or have any signs or symptoms

until extensive damage has been done to the eyes. Because cataracts, glaucoma, diabetic retinopathy, and macular degeneration are “silent” in nature, targeted screening for these diseases is essential.

Early detection cannot reverse pre-existing damage but it allows for timely treatment to be initiated and the available therapies can prevent further damage. Progression of the disease can be slowed, and can, in some cases, help restore some degree of vision loss.