Glaucoma — The Silent Thief of Sight
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Worldwide, it is estimated that about 66.8 million people have visual impairment from glaucoma, with 6.7 million suffering from blindness.\(^{(1)}\) In the U.S., approximately 2.2 million people have glaucoma and, of these, as many as 120,000 are blind due to the condition.\(^{(1,2)}\) By the year 2020, the number of Americans with glaucoma is estimated to increase to 3.3 million. Each year there will be more than 300,000 new cases of glaucoma and, of those, 5,400 will suffer complete blindness.\(^{(1)}\)

Glaucoma is a leading cause of blindness among Hispanics and African Americans in the United States. The Los Angeles Latino Eye Study (LALES), an epidemiological analysis of visual impairment in Latinos, found that 75% of those with glaucoma or ocular hypertension were undiagnosed before participating in LALES.\(^{(3)}\) African Americans experience glaucoma at a rate of three to four times more frequently, and blindness six times more frequently, than Caucasians.\(^{(4)}\) Those in whom glaucoma develops between the ages of 45 and 64 are more likely to have severe damage to the optic nerve develop,\(^{(5)}\) which is 15 times more likely to cause blindness.\(^{(6,7)}\)

Glaucoma, once thought of as a single disease, is a broad term for a group of certain pattern damage to the optic nerve. This normally occurs when there is high intraocular pressure (IOP); however, vision loss can occur with normal or even below-normal pressure.\(^{(2,8)}\) Optic nerve damage results in decreased peripheral vision and, eventually, blindness. Even those who do not become blind face immense hardships as their vision can be severely impaired. It is estimated that half of those affected may not know they have glaucoma, because symptoms do not normally occur during the early stages. By the time the patient notices something is wrong, the disease has already caused considerable damage. Unfortunately, the vision lost to glaucoma cannot be restored. Glaucoma is a chronic disease, which can be controlled, and further loss of sight either prevented or appreciably slowed down, with medications and surgery in the majority of patients. At this time there is no cure and it must be treated for life; however, much is happening in research, so a cure may be realized in our lifetime.

There are two main types of glaucoma: primary open angle glaucoma (POAG) and primary angle closure glaucoma. The less known variations include secondary glaucomas, pigmentary and congenital.

POAG is the most common form of glaucoma and is often called “the silent thief of sight.” This disease typically occurs after the fifth decade of life, normally affects both eyes, and there is a normal appearance to the structures in the anterior segment of the eye.\(^{(9)}\) Research has shown that this type of glaucoma is primarily inherited. Among those whose mothers or fathers have POAG, this disease is are 7 to 10 times more
likely to develop than in the general population. There are usually no symptoms or early warning signs, and approximately half of Americans with this type of glaucoma may be unaware they have it. POAG can occur when the eye's drainage canals become clogged over time. The IOP rises because the correct amount of aqueous doesn't drain from the eye. With open angle glaucoma, the entrances to the drainage canals are clear, with clogging occurring inside the drainage canals. If not diagnosed and treated, loss of vision begins with peripheral or side vision. This type of vision loss can be easily compensated for (by turning the head to the side) and may not be noticed until significant vision is lost. As the destruction progresses, tunnel vision develops and patients will only be able to see objects that are straight ahead. POAG usually responds well to medication, especially if diagnosed early and treated.

Primary Angle Closure Glaucoma, also known as “acute glaucoma” or “narrow angle glaucoma,” occurs in less than 10% of glaucoma patients and is very different from open angle glaucoma. It normally occurs in only one eye and, as the eye pressure quickly increases, it produces sudden symptoms such as eye pain, headache, haloes around lights, dilated pupil, vision loss, red eye, nausea, and vomiting. Optic nerve damage and vision loss will occur within hours if the angles are not opened to drain aqueous and lower IOP. Angle closure glaucoma occurs when drainage canals get completely blocked or covered over. If the iris and cornea are not as wide and open as they should be, the outer edge of the iris bunches up over the drainage canals. This can occur when the pupil enlarges too much or too quickly, and may be triggered by anything dilating the pupil (e.g., dim illumination, dilation drops used during an eye exam, or certain medications [antihistamine/decongestant drops or cold medications]).

While Asian Americans are not in a particularly high-risk group for glaucoma, there does seem to be some risk for development of acute angle-closure glaucoma. Acute angle-closure glaucoma is a medical emergency. If the IOP is not reduced within hours, it can permanently damage vision. Anyone who experiences its symptoms should immediately contact an eye care professional or go to a hospital emergency room.

During a routine eye exam the optometrist will use a slit-lamp (biomicroscope) to evaluate the anterior chamber, accessing whether angles are normal and wide or abnormal and narrow. If a narrow angle is observed, the optometrist may recommend preventive treatment, which usually involves laser surgery. Usually, a laser peripheral iridotomy (LPI) is performed to allow the iris to move posteriorly, away from the angle. In some cases, a trabeculotomy is performed to remove a small portion of the outer edge of the iris to help unblock the drainage canals so that the extra aqueous can drain. Surgery is normally successful and long-lasting. However, regular check-ups are essential.

NTG is also known as “low-tension glaucoma” or “normal pressure glaucoma.” With this type of glaucoma, the optic nerve is damaged, even though IOP is not high or may even be below normal. It is not known why some people’s optic nerves are damaged even though they have what are considered to be "normal" pressure levels. However, some researchers believe it may be related to poor blood flow to the optic nerve. NTG is usually detected during a routine eye exam, when the optometrist
examines the optic nerve and visual fields are performed.

The NTG Study was a collaborative effort of 24 research and medical centers around North America and Europe. The study evolved from a Glaucoma Research Foundation research meeting in 1984 and was designed to answer the question of whether it is beneficial to lower eye pressures when they are already at a normal level. It was the first multi-center clinical trial that documented the effectiveness of current treatment for any form of glaucoma. Researchers reported in the October 1998 issue of the American Journal of Ophthalmology, "Intraocular pressure is part of the pathogenic process in normal tension glaucoma." Therapy that is effective in lowering intraocular pressure and free of adverse effects would be expected to be beneficial in patients who are at risk of disease progression.\(^{(10,11)}\) During this study, researchers identified certain risk factors for glaucoma and information about the benefits of treatment that are used with other forms of glaucoma. It was found that the use of eye drops that lower IOP were effective. Currently, optometrists treat normal tension glaucoma by keeping eye pressures as low as possible with medicines, laser surgery, or filtering surgery. It was also found that those at a higher risk for this form of glaucoma are females, those of Japanese ancestry, people with a family history of normal tension glaucoma, or with a history of systemic heart disease, such as irregular heart rhythm.\(^{(8,10,11)}\)

"Congenital glaucoma" is a lesser-known form of glaucoma affecting children. It is present at or near birth and may occur because of an abnormality of the eye’s drainage system, or it may be secondary to another eye or systemic condition. If diagnosed within the first 3 years of life, it is referred to as “infantile” and “juvenile” if it occurs after the age of 3. Approximately 80% of cases are diagnosed by age 1. It affects male children more often (65%), and 70% of the cases are bilateral.

A child’s ocular tissues are elastic and stretch easily if IOP is elevated prior to age 3, the eye will become enlarged and distended. If left untreated, the high IOP may cause a layer of the cornea to stretch and rupture, causing tearing, light sensitivity, and corneal clouding. Congenital glaucoma may be associated with many systemic conditions (e.g., neurofibromatosis, congenital rubella, Lowe syndrome, Sturge-Weber syndrome, Marfan syndrome, etc.). If the condition is suspected, the child is usually examined under general anesthesia in order to measure the eye pressure accurately, examine the angle of the eye, and evaluate the optic nerve. If congenital glaucoma is diagnosed, it is treated with a surgical procedure called a goniotomy, which uses a goniolens that allows the eye care specialist to examine the angle and create an opening for the fluid to pass through. This procedure may be repeated if it does not initially control IOP adequately and, if pressure continues to remain high, a trabeculotomy and/or trabeculectomy may be performed. If these procedures do not adequately lower IOP, an implantation of a glaucoma drainage device, or destruction of the ciliary body to reduce the production of aqueous fluid, may be required.

“Secondary glaucomas” are defined as disorders causing glaucoma in association with a preexisting anatomic or physiologic ocular condition. However, some of these glaucomas are clearly not inherited, such as those that are caused by the use of certain drugs such as steroids. A March 1997 study in the Journal of the American
Medical Association reported a 40% increase in the incidence of ocular hypertension and open angle glaucoma in adults with severe asthma who require high doses of approximately 14 to 35 puffs of steroid inhaler. (12) It has also been reported that an infection, inflammation, tumor, advanced diabetes, or cataract can also cause secondary glaucoma.

Secondary glaucoma, which develops after an eye injury that affects the drainage system, may also be referred to as “Traumatic Glaucoma.” This can occur after a blunt trauma to the head or directly to the eye. Traumatic glaucoma is most commonly caused from sports-related injuries such as baseball or boxing and can occur immediately after the injury or years later as the result of damage to the drainage system.

“Pigmentary glaucoma” is another form of secondary glaucoma, occurring when the pigment granules in the back of the iris break into the aqueous produced inside the eye. These tiny pigment granules flow toward the drainage canals in the eye and slowly clog them, preventing aqueous humor from leaving the eye. Over time, inflammatory response to blocked angles occurs and damages the drainage system. Most patients exhibit no symptoms, and those who do report some pain and blurry vision after exercise. Pigmentary glaucoma affects mostly white males in their mid-30s to mid-40s. (2) Treatment usually includes medications or surgery. (8)

Many people over age 60 may have both glaucoma and cataracts, as both can be a natural part of the aging process. Normally, glaucoma does not cause cataracts, and cataracts do not cause glaucoma. Both conditions can cause patients to lose vision. However, loss of vision due to cataracts can be reversed with surgery. Loss of vision from glaucoma is, as yet, irreversible. (8) Secondary forms of glaucoma may be mild or severe. The type of treatment will depend on whether it is open angle or angle closure glaucoma.

Ocular hypertension occurs with elevated IOP, but without vision loss and optic nerve damage associated with glaucoma. Ocular hypertension by itself will not damage vision or eyes, but, like glaucoma, there are no outward signs. However, there is an increased risk that POAG may develop in those with ocular hypertension. At each eye examination, the optometrist will measure IOP and compare it to normal levels and may also check clinical risk factors, specifically corneal thickness and cup-to-disk ratio. Ocular hypertension can develop in anyone, but it’s most common in African-Americans, people over 40, those with a family history of ocular hypertension or glaucoma, and individuals with diabetes or high amounts of nearsightedness. Normal pressures range from 20 to 21 mmHg and anything over 21 is considered abnormal. Occasionally, however, a person's normal eye pressure is simply higher than average.

In 1997 “The Ocular Hypertension Treatment Study” (OHTS) was initiated and followed 1,636 patients with ocular hypertension (IOP between 24 mmHg and 32 mmHg in one eye and between 21 mmHg and 32 mmHg in the other eye), with no glaucomatous damage for more than 60 months. Patients were randomized to either observation or treatment with a topical hypotensive medication. (13) The study found that
Topical hypotensive medication was effective in delaying or preventing the onset of POAG in individuals with elevated IOP.\(^{(14)}\) This was especially evident in African American participants, in whom it was reported that in 8.4% of those in the medication group POAG developed during the study compared with 16.1% of those who did not receive treatment.\(^{(4)}\) The study also found that baseline age, vertical and horizontal cup-to-disk ratio, pattern standard deviation, and IOP were good predictors for the onset of POAG. However, central corneal thickness was also found to be a significant predictor for the development of POAG.\(^{(13)}\)

Since those with ocular hypertension are at increased risk for development of glaucoma, the optometrist may prescribe medication that will lower IOP. However, even with the results from the OHTS, the optometrist may choose to monitor IOP and take action if there are signs of developing glaucoma, since these medications can have side effects. For those patients with ocular hypertension, it is important they have a complete eye exam performed at recommended intervals, so any changes can be diagnosed early, before significant vision is lost.

In conclusion, there are many types of glaucoma, and evidence that heredity, race, and gender may make certain individuals more susceptible to development of this disease. With most forms of glaucoma there are no recognizable symptoms, so, without routine eye exams, most patients are unaware there is anything wrong with their vision. By the time patients realize they have a problem with their vision, considerable damage has occurred and lost vision cannot be restored. Early detection and the establishment of a regimen of therapy (i.e., medication or surgery) will stop or slow down the progression of vision loss, so more vision can be saved for the patient. As paraoptometrics, it is important paraoptometrics assist their optometrists in educating patients in the importance of regular visual exams.
References
“Glaucoma: The Silent Thief of Sight”
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Select the option that best answers the question.

1. Glaucoma is a leading cause of blindness among _____________ in the United States.
   a. Persons of Asian and Caucasian descent
   b. Persons of Caucasian and African American descent
   c. Persons of Asian and Hispanic descent
   d. Persons of African American and Hispanic descent

2. African Americans experience blindness from glaucoma at a rate of ____________ times more frequently than Caucasians.
   a. 2
   b. 5
   c. 6
   d. 10

3. Among those in whom glaucoma develops between the ages of 45 and 64, what is more likely to develop:
   a. Severe damage to the optic nerve, which is 15 times more likely to cause blindness.
   b. Severe damage to the optic nerve, which is less likely to cause blindness.
   c. Severe damage to the optic nerve, which is 5 times more likely to cause blindness.
   d. Severe damage to the optic nerve, which is 10 times more likely to cause blindness.
4. It is estimated that half of those affected may not know they have glaucoma because symptoms do not normally occur during the early stages.
   a. True
   b. False

5. Vision lost to glaucoma can be restored with treatment.
   a. True
   b. False

6. At this time there is no cure and glaucoma must be treated for life.
   a. True
   b. False

7. The most common form of glaucoma is:
   a. Primary open angle
   b. Angle closure
   c. Pigmentary
   d. Congenital

8. Loss of vision from glaucoma begins with:
   a. Distant vision
   b. Central vision
   c. Near vision
   d. Peripheral or side vision

9. Patients suffering from Angle Closure Glaucoma have which of the following symptoms?
   a. Eye pain, headaches
   b. Haloes around lights and dilated pupil
   c. Vision loss and red eye
   d. Nausea and vomiting
   e. All of the above

10. A patient with acute angle-closure glaucoma should be seen when?
    a. Next available appointment
    b. Within days
    c. Within hours
    d. At their next scheduled check-up

11. No damage occurs to the optic nerve with normal tension glaucoma.
    a. True
    b. False

12. Those at a higher risk for development of normal tension glaucoma are:
    a. Females
    b. People with a family history of normal tension glaucoma
    c. Japanese ancestry
    d. History of systemic heart disease
    e. All of the above
13. Congenital glaucoma is present and normally detected by:
   a. Age 10
   b. Age 18
   c. At or near birth
   d. Age 21

14. Secondary glaucoma may occur with:
   a. Increasing age or trauma
   b. Infection, inflammation, or tumor
   c. Advanced diabetes or cataract
   d. Use steroid drugs or loss of pigment from iris
   e. All of the above

15. Ocular hypertension occurs:
   a. With normal IOP, vision loss, and optic nerve damage
   b. With elevated IOP, vision loss, and optic nerve damage
   c. With elevated IOP, but without vision loss and optic nerve damage
   d. With below normal IOP, vision loss, and optic nerve damage

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