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PHARMACOLOGY

PHS 212

Discuss the defect of the eye

◆GLAUCOMA

Glaucoma is a group of diseases characterized by increased intraocular pressure, which causes damage of optic nerve, resulting in blindness.

In glaucoma, the drainage of aqueous humor through trabeculae is blocked, resulting in increased intraocular pressure. When the intraocular pressure rises above 60mmHg, the optic nerve fibers at the optic disk are compressed. Initially it decreases the visual field (loss of peripheral vision), which eventually leads to total blindness.

However, with early treatment, often the eyes may be protected against serious vision loss. Untreated glaucoma leads to permanent damage of the optic nerve and results in blindness. In old age, glaucoma occurs due to the obstruction of trabeculae by fibrous structures.

Types of Glaucoma

Elevation of intraocular pressure causing glaucoma can occur at any stage of life. Congenital glaucoma develops in babies born with increased intraocular pressure. Glaucoma in infants is called infantile glaucoma. When it occurs in childhood, it is known as juvenile glaucoma.

Generally glaucoma is divided into two types:

1. Primary open-angle glaucoma
2. Primary angle-closure glaucoma.

1. Primary open-angle glaucoma (POAG)

POAG is the most common type of glaucoma and it accounts for about 80% of all cases of glaucoma. The term open-angle refers to drainage system, which is responsible for draining the aqueous humor from the eye. Actually, in POAG there is no visible obstruction in the drainage system. Still intraocular pressure increases, causing damage to optic nerve. Exact cause of POAG is not known yet. It is suggested that a microscopic (minute) blockage in drainage system beyond limbus may obstruct the flow of aqueous humor. It causes a gradual increase in intraocular pressure.

2. Primary angle-closure glaucoma (PACG)

PACG is characterized by visible obstruction of drain- age system for aqueous humor. Iris is pushed against cornea, preventing the drainage of aqueous humor. Intraocular pressure rises over the period of few hours.

Causes of Glaucoma

Major cause of glaucoma is the blockage in drainage system of aqueous humor in trabeculae, resulting in increased intraocular pressure. Glaucoma also develops secondary to other disorders, which affect the eyes. Common causes of secondary glaucoma are diabetes, inflammation or injury to eye and excess use of drugs such as corticosteroid.

Symptoms of Glaucoma

Primary open-angle glaucoma is a silent chronic disease without any early symptoms. Symptoms that

develop in later stages include heaviness around eyeball, headache and rapid reduction in visual

acuity and visual field.

Early symptoms of angle-closure glaucoma are severe pain in eye or eyebrow, headache, nausea, blurred vision and rainbow halo (colored rings) around bulb light. Immediate care should be taken if two or more of these symptoms appear together.

Treatment for Glaucoma

Treatment does not cure the disease but can prevent further damage of optic nerve. Treatment is aimed at lowering the intraocular pressure. It is achieved by using eye drops or medicines alone or in combination with laser treatment. If intraocular pressure cannot be controlled by these methods, surgery is required.

◆CATARACT

Cataract is the opacity or cloudiness in the natural lens of the eye. It is the major cause of blindness worldwide. When lens becomes cloudy, light rays cannot pass through it easily and vision is blurred. Cataract develops in old age after 55 to 60 years.

Lens is situated within the sealed capsule. Old cells die and accumulate within the capsule. Over years, the accumulation of cells is associated with accumulation of fluid and denaturation of proteins in lens fibers, causing cloudiness of lens and blurred image.

Causes of Cataract

In addition to age, cataract develops due to many other causes such as:

1. Eye injuries
2. Previous eye surgery
3. Diseases such as diabetes, Wilson disease and hypocalcemia
4. Long-term use of drugs such as steroids, diuretics and tranquilizers
5. Long-term unprotected exposure to sunlight
6. Alcoholism
7. Family history
8. Diet containing large quantity of salt.

Symptoms of Cataract

Common symptoms of cataract:

1. Glare
2. Painless blurred vision
3. Poor night vision
4. Diplopia in affected eye
5. Need for a bright light while reading
6. Fading of colors.

Treatment for Cataract

Surgery is the only treatment for cataract. During surgery, cloudy lens is removed from the eye through a surgical incision. The natural lens is replaced with a permanent, clear and plastic intraocular lens (IOL) implant. Different procedures are followed to remove the cloudy lens.

Common methods are:

- 1. Extracapsular extraction**

Extracapsular extraction is rather an old technique. A 12 mm incision is made in the eye under an operating microscope, to remove the lens as a whole. Posterior capsule of lens is left in place to hold the IOL implant. Multiple sutures are required to seal the eye after surgery. Sutures must be perfect; otherwise astigmatism may develop.

2. Phacoemulsification

Phacoemulsification (Phaco) is the current technique. Phaco is the procedure in which cataract is broken into smaller fragments by ultrasonic vibrations. It is done through a small (3 mm) incision. An ultrasound (or laser) probe is used to break the lens material without damaging the capsule. Lens fragments are aspirated out of the eye. A foldable IOL is then introduced through the incision. After entering the eye, the lens unfolds to take position inside the capsule. No sutures are needed, as the incision is self-sealing.

◆Myopia

Myopia is a defect of vision wherein far-off objects appear blurred and objects near are seen clearly. Since the eyeball is too long or the eye lens's refractive power is too high; the image forms in front of the retina rather than forming on it. Correction of myopia can happen by wearing glasses/contacts made of concave lenses to help focus the image on the retina.

This is a defect of vision in which far objects appear blurred but near objects are seen clearly. The image is focused in front of the retina rather than on it usually because the eyeball is too long or the refractive power of the eye's lens too strong. Myopia can be corrected by wearing glasses/contacts with concave lenses these help to focus the image on the retina.

Nearsightedness (myopia) is a common vision condition in which you can see objects near to you clearly, but objects farther away are blurry. It occurs when the shape of your eye causes light rays to bend (refract) incorrectly, focusing images in front of your retina instead of on your retina. Nearsightedness may develop gradually or rapidly, often worsening during childhood and adolescence. Nearsightedness tends to run in families.

A basic eye exam can confirm nearsightedness. You can compensate for the blur with eyeglasses, contact lenses or refractive surgery.

There are several types of myopia. The sections below will discuss these in more detail.

Simple myopia

In simple myopia, the eye is otherwise healthy. Wearing glasses or contact lenses can easily correct the issues that a person has with their vision.

High myopia

High myopia is a more severe form of myopia. It occurs when a person develops nearsightedness at a young age that gets worse as they get older.

High myopia can increase a person's risk of developing certain other eye conditions, such as retinal detachment, glaucoma, or cataracts.

Pathological myopia

People with pathological, or degenerative, myopia will have additional eye conditions. The eye will also have issues that affect the retina, such as:

- lattice degeneration, which is a type of retinal thinning
- retinal atrophy, wherein parts of the retina have wasted and do not work
- Forster-Fuchs' spot, which is a type of scarring on the retina that can lead to blind spots

Pathological myopia can also cause vision loss that glasses or contact lenses cannot correct.

Symptoms

Nearsightedness symptoms may include:

- Blurry vision when looking at distant objects
- The need to squint or partially close the eyelids to see clearly
- Headaches caused by eyestrain
- Difficulty seeing while driving a vehicle, especially at night (night myopia)

Nearsightedness is often first detected during childhood and is commonly diagnosed between the early school years through the teens. A child with nearsightedness may:

- Persistently squint
- Need to sit closer to the television, movie screen or the front of the classroom
- Seem to be unaware of distant objects
- Blink excessively
- Rub his or her eyes frequently

Causes

Anatomy of the eye

Open pop-up dialog box

Your eye has two parts that focus images:

- The cornea is the clear, dome-shaped front surface of your eye.
- The lens is a clear structure about the size and shape of an M&M's candy.

In a normally shaped eye, each of these focusing elements has a perfectly smooth curvature, like the surface of a marble. A cornea and lens with such curvature bend (refract) all incoming light to make a sharply focused image directly on the retina, at the back of your eye.

A refractive error

If your cornea or lens isn't evenly and smoothly curved, light rays aren't refracted properly, and you have a refractive error.

Nearsightedness usually occurs when your eyeball is longer than normal or your cornea is curved too steeply. Instead of being focused precisely on your retina, light is focused in front of your retina, resulting in a blurry appearance for distant objects.

Other refractive errors

In addition to nearsightedness, other refractive errors include:

- **Farsightedness (hyperopia).** This occurs when your eyeball is shorter than normal or your cornea is curved too little. The effect is the opposite of nearsightedness. In adults, both near and distant objects are blurred.
- **Astigmatism.** This occurs when your cornea or lens is curved more steeply in one direction than in another. Uncorrected astigmatism blurs your vision.

◆Astigmatism

Astigmatism is a common vision condition that causes blurred vision. It occurs when the cornea (the clear front cover of the eye) is irregularly shaped or sometimes because of the curvature of the lens inside the eye.

An irregularly shaped cornea or lens prevents light from focusing properly on the retina, the

light-sensitive surface at the back of the eye. As a result, vision becomes blurred at any distance. This can lead to eye discomfort and headaches.

Causes of astigmatism

The curvature of the cornea and lens bends the light entering the eye in order to focus it precisely on the retina at the back of the eye. In astigmatism, the surface of the cornea or lens has a somewhat different curvature.

The surface of the cornea is shaped more like a football instead of round like a basketball, the eye is unable to focus light rays to a single point. Vision becomes out of focus at any distance.

In addition, the curvature of the lens inside the eye can change, resulting in an increase or decrease in astigmatism. This change frequently occurs in adulthood and can precede the development of naturally occurring cataracts.

- Sometimes astigmatism may develop following an eye injury or eye surgery.

Astigmatism also occurs due to a relatively rare condition called keratoconus in which the cornea becomes progressively thinner and cone-shaped. This results in a large amount of astigmatism, which causes poor vision that cannot be clearly corrected with eyeglasses. People with keratoconus usually need contact lenses for clear vision and eventually may need a corneal transplant.

- Astigmatism frequently occurs with other vision conditions like myopia (nearsightedness) and hyperopia (farsightedness). Together these vision conditions are referred to as refractive errors because they affect how the eyes bend or "refract" light.

There are many causes to astigmatism. It can be hereditary and is usually present from birth. It can decrease or increase over time.

Diagnosis of astigmatism

An optometrist can diagnose an astigmatism through a comprehensive eye examination. Testing for astigmatism measures how the eyes focus light and determines the power of any optical lenses needed to improve vision. This examination may include:

- **Visual acuity**

When you read letters on a distance chart, you are measuring your visual acuity. Visual acuity is given as a fraction (for example, 20/40). The top number is the standardized testing distance (20 feet) and the bottom number is the smallest letter size read. A person with 20/40 visual acuity would have to get within 20 feet to read a letter that should be seen clearly at 40 feet. Normal distance visual acuity is 20/20.

- **Keratometry/Topography**

A keratometer is the primary instrument used to measure the curvature of the cornea. By focusing a circle of light on the cornea and measuring its reflection, it is possible to determine the exact curvature of that area of the cornea's surface. This measurement is particularly critical in determining the proper fit for contact lenses. A corneal topographer, which is gaining use, generates a contour map of the cornea and provides even more detail of the cornea's shape.

- **Refraction**

Using an instrument called a phoropter, your optometrist places a series of lenses in front of your eyes and measures how they focus light. This is performed using a handheld lighted instrument called a retinoscope or an automated instrument that evaluates the approximate focusing power of the eye. Based on your responses, the power is then refined to determine the lenses that allow the

clearest vision. Despite improved technology, patient input remains integral in determining vision needs.