

# Anatomy and Pathophysiology

for ICD-10

2014

Module 10



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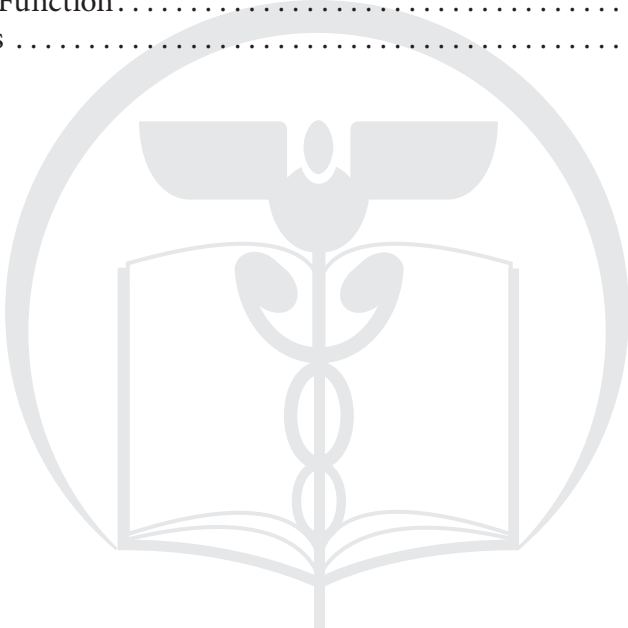
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## Terminology

**Accommodation**—The ability of the lens to focus clearly on objects at various distances.

**Amblyopia**—Reduced vision that is not correctable by lenses and has no pathological cause.

**Aphakia**—Absence of the lens of the eye.

**Blepharoptosis**—Drooping of the upper eyelid.

**Blepharospasm**—A condition causing the eyelid muscles to twitch.

**Corneal Topography**—Process for mapping the surface curvature of the cornea.

**Diplopia**—Double vision caused by each eye focusing separately.

**Esotropia**—An obvious inward turning of one eye in relation to the opposite eye.

**Exotropia**—An obvious outward turning of one eye in relation to the opposite eye.

**Gonioscopy**—A diagnostic test used to view the anterior chamber angle of the eye to determine if abnormal angle structure is present.

**Keratoconjunctivitis**—Inflammation of the cornea and the conjunctiva of the eye.

**Optician**—A health care professional (not an M.D.) who specializes in filling prescriptions for glasses or contact lenses.

**Optometrist**—A doctor of optometry (O.D.) who examines the eye to determine problems and writes prescriptions for glasses or contact lenses.

**Pseudophakia**—Indicates the natural lens of an eye has been replaced with an intraocular lens.

**Refraction**—A test performed by an eye doctor to determine the prescription required to correct one's vision.

**Slit-lamp exam**—A low powered microscope combined with a high-intensity light source used to examine the internal and external structures of the eye.

**Strabismus**—Failure of the eyes to gaze in the same direction due to weakness in the muscles controlling the position of one eye.

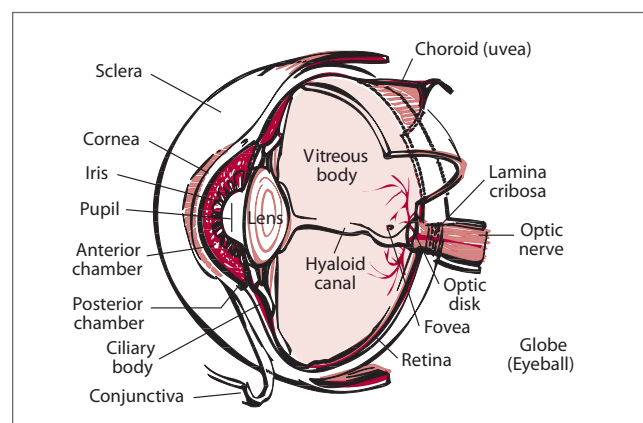
## Introduction

The eyes are the most complex of all the sensory organs involving a much larger area of the brain than other senses. The cells of the eye that support vision are typically activated by a stimulus, such as light. They collect light waves and transmit them as nerve impulses along the visual pathways to the brain, which translates them to images.

The eye is often compared to a camera. Each gathers light and then transforms that light into a “picture.” Both also have lenses to focus the incoming light. A camera uses the film to create a picture, whereas the eye uses a specialized layer of cells, called the retina, to produce an image.

## Eye Anatomy and Function

Several structures compose the eye. Among the most important anatomical components are the cornea, conjunctiva, iris, crystalline lens, vitreous humor, retina, macula, optic nerve, and extraocular muscles.



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There are three layers of tissue that compose the spherical structure of the eye—the sclera (the outermost layer), the choroid (the middle layer), and the retina (the innermost layer). Within each of these layers are further subdivided regions that entail more specific functions.

**Sclera and cornea**—the sclera, which is the outermost layer, consists of tough fibrous tissue to protect it from the external environment. It is visible as the white part of the eye and it assists in maintaining the “globe” shape. The sclera includes two episcleral layers called Schlemm’s canal and trabecular meshwork.

Schlemm’s canal, also known as the scleral venous sinus, is a “tube” (resembling that of a lymphatic vessel) in the eye that collects aqueous humor from the anterior chamber and delivers it into the blood stream via the anterior ciliary veins.

Trabecular meshwork is an area of tissue in the eye located around the base of the cornea, near the ciliary body. It is made up of spongy tissue, lined by trabeculocytes, and allows fluid to drain from the eye into Schlemm’s canal via the anterior chamber.

The anterior cornea is also located in the outermost layer of the eye. It is made up of a transparent fibrous coat covering the front of the eye including the iris, pupil, and anterior chamber. The cornea works with the lens to refract light, accounting for approximately two-thirds of the eye’s total optical power. Initially, the light waves are converged (bent) by the cornea. The crystalline lens further bends the waves and the image becomes backwards and upside down. Lacrimal glands keep the surface of the cornea moist and free from foreign bodies.

The choroid is the middle layer of tissue next to the sclera. There are three regions in this middle layer: choroid, ciliary body, and iris. The choroid is a highly vascularized area that surrounds most of the eye to provide oxygen and nutrients to the outer layers of the retina. Together the choroid, ciliary body, and the iris form the uveal tract.

The ciliary body produces aqueous humor, which is important to the function of the eye as it provides not only optical power to the cornea, but also assists in maintaining intraocular pressure, shape to the globe, and assists in the delivery of nutrients to tissues. Suspensory ligaments attach the lens to the ciliary muscle.

When the ciliary body contracts, the suspensory ligaments relax causing the lens to thicken, allowing the ability to focus up close. Viewing distant objects causes the ciliary body to relax and the suspensory ligaments to contract. The lens becomes thinner, allowing the ability to focus far away.

Light waves from an object enter the eye through the cornea. The iris is the colored portion of the eye, which helps to regulate the amount of light entering the eye by controlling the size of the pupil. The pupil is seen from the outside as the black innermost circle of the eye within the iris. Bright lights cause the pupil to constrict (get smaller), while dim lighting causes the pupil to dilate (get larger). Oftentimes, the ophthalmologist will put drops in the eyes to dilate them so he or she can perform a comprehensive exam of the eye. The external object is seen like the camera takes a picture of an object. Light enters through the pupil and is focused on the retina, much like camera film.

The retina is the inner layer of the eye consisting mainly of nervous tissue. Its inner, transparent neural layer contains photoreceptors (rods and cones) for processing of external images. The retina of the eye contains about 137 million light-sensitive cells in an area of about 650 sq. mm/1 sq. in. There are 130 million rod cells for black and white vision and 7 million cone cells for color vision. The focusing muscles of the eye adjust about 100,000 times a day. In the center of the retina is the optic nerve, a circular to oval white area. Major blood vessels radiate from the center of the optic nerve, which contains about 1 million nerve fibers.

Light rays enter the eye and converge on the retina, where an upside-down image is created. The retina of each eye relays impulses to the brain through the optic nerves, which cross paths at a junction call the optic chiasm; half the nerve fibers from the right eye cross to the left, and vice versa, before passing on to the brain. In the visual cortex the image is turned upright.

Near the center of the retina is an oval-shaped highly pigmented yellow spot called the macula. Due to the yellow color of the macula it absorbs excess blue and ultraviolet light that enter the eye, and acts as a natural sunblock for this area of the retina. Within the macula is the fovea, a small pit that contains the largest concentration of cone cells in the eye and is responsible for

central, high-resolution vision. If the macula begins to degenerate, central vision begins to diminish.

The anterior chamber is the space in the eye that is behind the cornea and in front of the iris. The posterior chamber is the space in the eye that is behind the iris and in front of the lens. The anterior and posterior chambers contain aqueous humor, a clear, watery fluid similar in composition to blood plasma. The posterior cavity contains vitreous humor, a thick, clear, gelatinous fluid making up about 80 percent of the eye's volume.

## Adnexa Structure and Function

The eyeball is set in a protective cone-shaped cavity in the skull called the “orbit” or “socket.” Layers of soft, fatty tissue to add additional protection, and allow the eye to turn easily surround the orbit. The accessory visual structures or adnexa of the eye include the eyelids, eyebrow, and eyelashes. All help to protect the eye, along with the lacrimal glands that lubricate the eye to reduce the risk of injury and remove small particles of material from the surface of the eye. Eyebrows and eyelashes filter out large materials that could cause injuries to the eye, keeping the surface of the eye as clean as possible to reduce the risks of irritation and infection. They also protect from very bright lights that may cause damage to the eye.

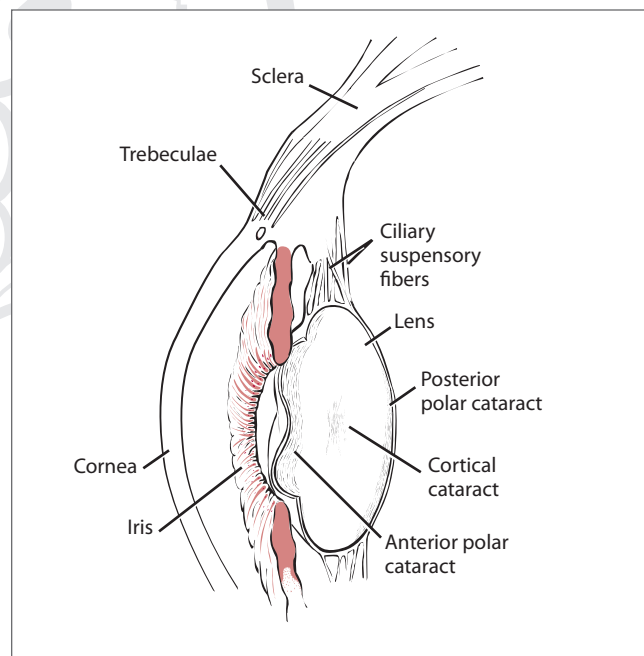
The conjunctiva lubricates the eye by producing mucus and tears. It is typically divided into three parts:

- Palpebral or tarsal conjunctiva lines the eyelids.
- Bulbar or ocular conjunctiva covers the outer surface of the eye and moves with the eyeball. It is tightly bound to the underlying sclera by Tenon's capsule.
- Fornix conjunctiva are loose arching folds that connect the bulbar and palpebral conjunctivae, allowing independent movement of the lids and eyeballs.

There are six small muscles located in the orbit that are responsible for the movements on the eye. These are known as the extraocular muscles due to the fact that they are outside of the eyeball. The actions of the extraocular muscles depend on the position of the eye at the time of muscle contraction. Five of these muscles

originate in the back of the orbit in a fibrous ring called the annulus of Zinn. The functions of the muscles are:

- Superior rectus—elevation, intorsion (rotation towards the center of the body) and adduction.
- Inferior rectus—depression, adduction, and lateral rotation of the eye.
- Lateral rectus—abduction or moving the pupil away from the midline of the body.
- Medial rectus—adduction or moving the pupil towards the midline of the body.
- Superior oblique—abduction, depression, and internal rotation of the eye.
- Inferior oblique—lateral rotation, elevation, and abduction of the eye.



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## Diseases and Disorders

### Cataracts

A cataract is a clouding that develops on the lens of the eye, which can obstruct the amount of light that comes through. There are varying degrees of opacity. Cataracts typically progress slowly causing loss of vision. Left untreated they can potentially lead to blindness. The condition usually affects both eyes, but most oftentimes,



one eye becomes affected earlier than the other. There are three different types of age related (senile) cataracts, which are characterized by their location on the lens:

- Nuclear sclerotic cataracts affect the center of the lens and are known to be the most common types of cataracts resulting from advancing age. They interfere with the ability to see far away.
- Cortical cataracts begin at the outer rim of the lens and gradually go to the center, resembling the spokes of a bicycle wheel and are most commonly found in people with diabetes.
- Posterior subcapsular cataracts affect the back of the lens causing glare and blurriness. These are considered the most rapidly progressive types of cataracts.

Cataracts are treated in various ways. Initially, they may be treated by a change in the eyeglass prescription. However, as they progress, surgery is the most common way to remove the cataract. There are three different types of surgery available:

- Phacoemulsification or photoemulsification is a type of extracapsular surgery in which the lens is softened with sound waves and then removed through a needle. A tiny probe is inserted through a very small incision on the side of the cornea producing a vibration at an extremely high rate of speed caused by high frequency sound waves. The ultrasonic vibration breaks the cataract into fine pieces, which are suctioned out of the eye through the needle. After all the cataract material is removed, the back half of the lens is left behind and the artificial lens is placed inside. The small incision closes on its own.
- Extracapsular surgery involves removing the eye's natural lens through a large incision, while leaving the back of the lens in place (which holds the lens in place).
- Intracapsular surgery is the removal of the lens and the surrounding lens capsule all in one piece. It is rarely used any longer due to the relatively high rate of complication due to the large size of the incision required for this procedure.

The ICD-10-CM code range for cataracts is H25.011–H28.

To code a cataract in ICD-10-CM the following is necessary:

- Type of cataract
- Laterality

Cortical age-related cataract, right eye	H25.011
Cortical age-related cataract, left eye	H25.012
Cortical age-related cataract, bilateral	H25.013
Cortical age-related cataract, unspecified eye	H25.019
Anterior subcapsular polar age-related cataract, right eye	H25.031
Anterior subcapsular polar age-related cataract, left eye	H25.032
Anterior subcapsular polar age-related cataract, bilateral	H25.033
Anterior subcapsular polar age-related cataract, unspecified eye	H25.039
Posterior subcapsular polar age-related cataract, right eye	H25.041
Posterior subcapsular polar age-related cataract, left eye	H25.042
Posterior subcapsular polar age-related cataract, bilateral	H25.043
Posterior subcapsular polar age-related cataract, unspecified eye	H25.049

In the above table, the laterality issue is shown. Note the fifth digits in the codes. The fifth digit of 1 denotes the right eye, the fifth digit of 2 denotes the left eye, the fifth digit of 3 denotes bilateral eyes, and the fifth digit of 9 denotes unspecified eye.

There are no ICD-10-CM guidelines related to this disease.

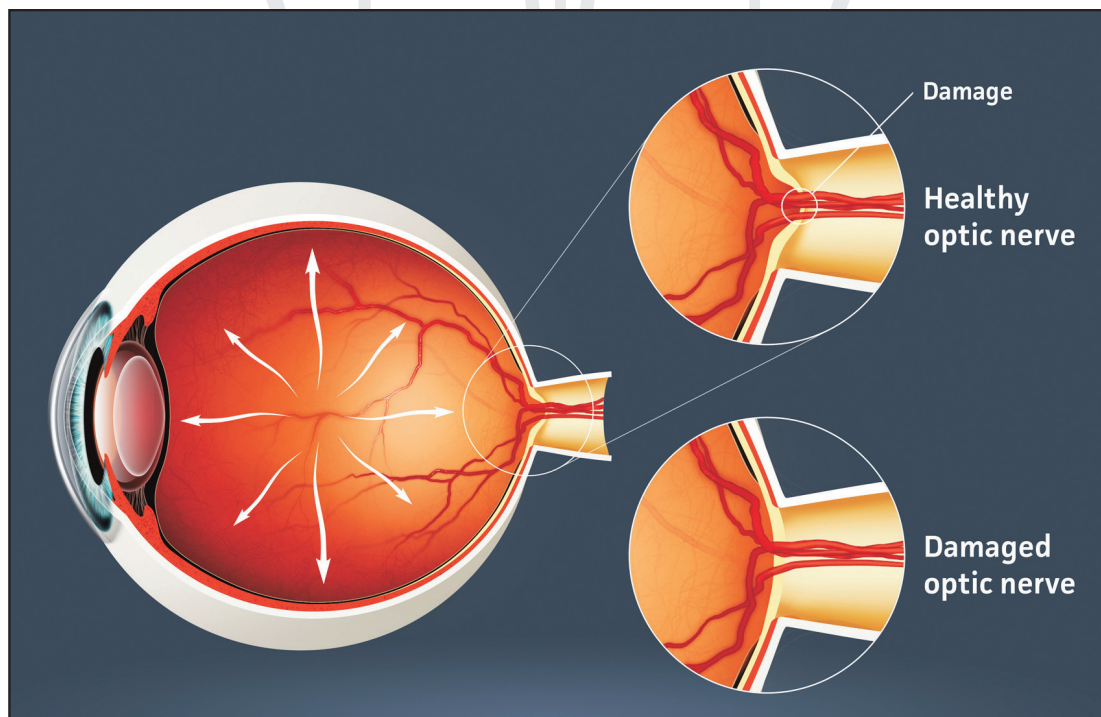
## Glaucoma

Glaucoma refers to a group of eye conditions that lead to damage to the optic nerve, the nerve that carries visual information from the eye to the brain. In many cases, damage to the optic nerve is due to increased pressure in the eye, also known as intraocular pressure (IOP). Glaucoma is the second most common cause of blindness in the United States.

The front part of the eye is filled with aqueous humor. This fluid is always being made in the back of the eye. It leaves the eye through channels in the front of the eye in an area called the anterior chamber angle, or simply the angle. Anything that slows or blocks the flow of this fluid out of the eye will cause pressure to build up in the eye.

Glaucoma can be divided roughly into two main categories, “open angle” and “closed angle” glaucoma. Closed angle glaucoma can appear suddenly and is often painful; visual loss can progress quickly but the discomfort often leads patients to seek medical attention before permanent damage occurs. Open angle, chronic glaucoma tends to progress at a slower rate and the patient may not notice that they have lost vision until the disease has progressed significantly.

There are two other types of glaucoma as well, congenital and secondary. Congenital glaucoma is hereditary so it is present at birth, resulting from abnormal development of the fluid outflow channels in the eye. Secondary glaucoma is the result of other conditions such as use of certain drugs (corticosteroids, some eye conditions, or systemic diseases).



Source: AAPC



The ICD-10-CM code range for glaucoma is H40.10–H42.

To code glaucoma in ICD-10-CM the following is necessary:

- Type of glaucoma
- Laterality

Acute angle-closure glaucoma, right eye	H40.211
Acute angle-closure glaucoma, left eye	H40.212
Acute angle-closure glaucoma, bilateral	H40.213
Acute angle-closure glaucoma, unspecified eye	H40.219

Chronic angle-closure glaucoma, right eye	H40.221
Chronic angle-closure glaucoma, left eye	H40.222
Chronic angle-closure glaucoma, bilateral	H40.223
Chronic angle-closure glaucoma, unspecified eye	H40.229

One of the following 7th characters is to be assigned to each code in subcategory H40.22 to designate the stage of glaucoma.

- 0 stage unspecified
- 1 mild stage
- 2 moderate stage
- 3 severe stage
- 4 indeterminate stage

Intermittent angle-closure glaucoma, right eye	H40.231
Intermittent angle-closure glaucoma, left eye	H40.232
Intermittent angle-closure glaucoma, bilateral	H40.233
Intermittent angle-closure glaucoma, unspecified eye	H40.239

In the previous table, the laterality issue is shown. Note the fifth digits in the codes. The fifth digit of 1 denotes the right eye, the fifth digit of 2 denotes the left eye, the fifth digit of 3 denotes bilateral eyes, and the fifth digit of 9 denotes unspecified eye.

Currently there are no ICD-10-CM guidelines related to this disease.

## Retinal Detachments

Retinal detachments are often associated with a tear or hole in the retina through which eye fluids may leak. This causes separation of the retina from the underlying tissues. Once the retina has torn, liquid from the vitreous gel can then pass through the tear and accumulate behind the retina. The buildup of fluid behind the retina is what separates (detaches) the retina from the back of the eye.

As more of the liquid vitreous collects behind the retina, the extent of the retinal detachment can progress and involve the entire retina, leading to a total retinal detachment. A retinal detachment almost always affects only one eye at a time. The second eye, however, must be checked thoroughly for any signs of predisposing factors that may lead to detachment in the future.

Retinal detachment often occurs on its own without an underlying cause. However, it may also be caused by trauma, diabetes, or an inflammatory disorder. It is most often caused by a related condition called posterior vitreous detachment.

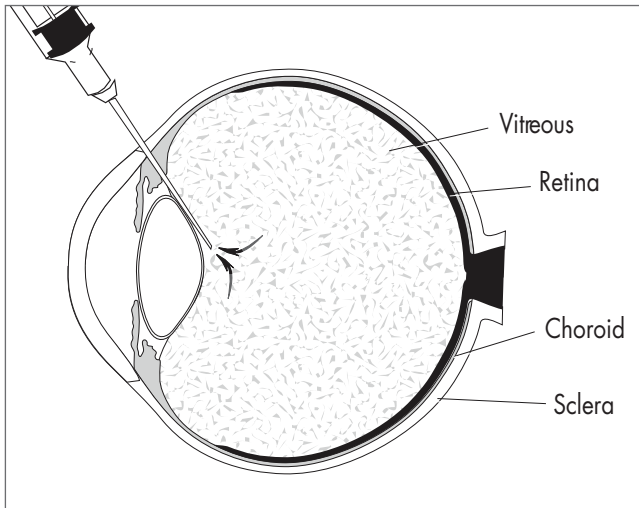
During a retinal detachment, bleeding from small retinal blood vessels may cloud the interior of the eye, which is normally filled with vitreous fluid. Central vision becomes severely affected if the macula, the part of the retina responsible for fine vision, becomes detached.

Some symptoms associated with retinal detachment include bright flashes of light in the peripheral vision, blurred vision, and floaters in the eye. Most patients with a retinal detachment will need surgery, either immediately or after a short period of time.

Types of surgery include:

- Cryopexy (intense cold applied to the area with an ice probe) to help a scar form, which holds the retina to the underlying layer

- Laser surgery to seal the tears or holes in the retina
- Pneumatic retinopexy (placing a gas bubble in the eye) to help the retina float back into place



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More extensive detachments may require surgery in an operating room. Such procedures include:

- Scleral buckle to indent the wall of the eye
- Vitrectomy to remove gel or scar tissue pulling on the retina

The ICD-10-CM code range for retinal detachment is H33.001–H33.8.

To code retinal detachments in ICD-10-CM the following is necessary:

- Type of detachment
- Laterality

Retinal detachment with single break, right eye	H33.011
Retinal detachment with single break, left eye	H33.012
Retinal detachment with single break, bilateral	H33.013
Retinal detachment with single break, unspecified eye	H33.019

Retinal detachment with multiple breaks, right eye	H33.021
Retinal detachment with multiple breaks, left eye	H33.022
Retinal detachment with multiple breaks, bilateral	H33.023
Retinal detachment with multiple breaks, unspecified eye	H33.029

Retinal detachment with giant retinal tear, right eye	H33.031
Retinal detachment with giant retinal tear, left eye	H33.032
Retinal detachment with giant retinal tear, bilateral	H33.033
Retinal detachment with giant retinal tear, unspecified eye	H33.039

In the above table, the laterality issue is shown. Note the fifth digits in the codes. The fifth digit of 1 denotes the right eye, the fifth digit of 2 denotes the left eye, the fifth digit of 3 denotes bilateral eyes, and the fifth digit of 9 denotes unspecified eye.

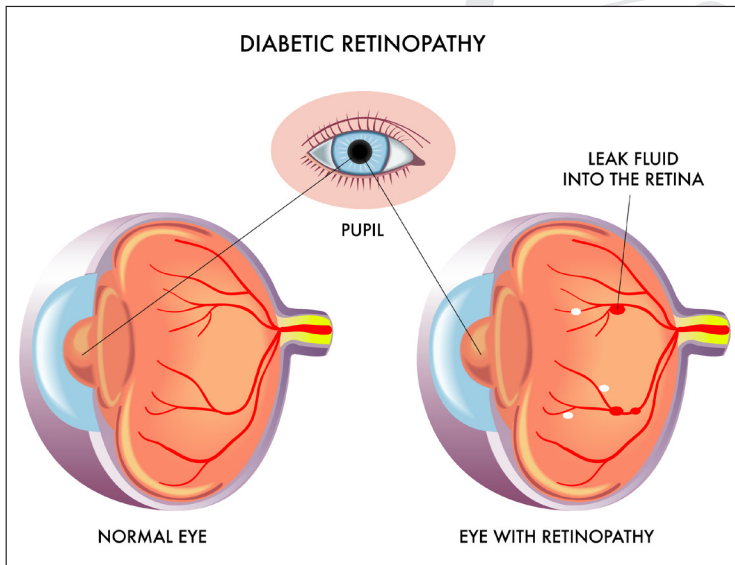
### Diabetic Retinopathy

Diabetic retinopathy is a condition that develops in patients with long-term diabetes causing damage to the blood vessels in the retina. It is the leading cause of blindness in the United States as over time the damage to the blood vessels causes a permanent decrease in the sharpness of vision. There are four stages of diabetic retinopathy:

- Mild nonproliferative retinopathy—This is the earliest stage where small balloon-like swelling occurs in the small vessels
- Moderate nonproliferative retinopathy—Indicates progression of the disease where the swelling turns into blockage

- Severe nonproliferative retinopathy—Condition has progressed so that the retina is being deprived of the necessary amount of blood supply to keep it healthy so signals are sent to the body to grow new vessels to replace the blocked ones
- Proliferative retinopathy—This is the advanced stage of diabetic retinopathy where the new vessels have grown, but they have very fragile and thin walls so they are at risk for leaking, which would cause the retina to be blocked resulting in complete blindness

In severe cases a surgical procedure called a vitrectomy may be required. A vitrectomy is a procedure to remove vitreous humor from the center of the eye. Prior to a vitrectomy, laser procedures may be performed to slow the leakage and reduce the amount of fluid in the retina.



Source: AAPC

To code for diabetic retinopathy in ICD-10-CM the following is necessary:

- Type of diabetes
- Severity of nonproliferative condition
- Proliferative or nonproliferative
- With or without macular edema

Type 1 diabetes mellitus with unspecified diabetic retinopathy with macular edema	E10.311
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Type 1 diabetes mellitus with unspecified diabetic retinopathy without macular edema	E10.319
Type 1 diabetes mellitus with mild nonproliferative diabetic retinopathy with macular edema	E10.321
Type 1 diabetes mellitus with mild nonproliferative diabetic retinopathy without macular edema	E10.329
Type 1 diabetes mellitus with moderate nonproliferative diabetic retinopathy with macular edema	E10.331
Type 1 diabetes mellitus with moderate nonproliferative diabetic retinopathy without macular edema	E10.339
Type 1 diabetes mellitus with severe nonproliferative diabetic retinopathy with macular edema	E10.341
Type 1 diabetes mellitus with severe nonproliferative diabetic retinopathy without macular edema	E10.349
Type 1 diabetes mellitus with proliferative diabetic retinopathy with macular edema	E10.351
Type 1 diabetes mellitus with proliferative diabetic retinopathy without macular edema	E10.359
Type 2 diabetes mellitus with unspecified diabetic retinopathy with macular edema	E11.311
Type 2 diabetes mellitus with unspecified diabetic retinopathy without macular edema	E11.319
Type 2 diabetes mellitus with mild nonproliferative diabetic retinopathy with macular edema	E11.321

Type 2 diabetes mellitus with mild nonproliferative diabetic retinopathy without macular edema	E11.329
Type 2 diabetes mellitus with moderate nonproliferative diabetic retinopathy with macular edema	E11.331
Type 2 diabetes mellitus with moderate nonproliferative diabetic retinopathy without macular edema	E11.339
Type 2 diabetes mellitus with severe nonproliferative diabetic retinopathy with macular edema	E11.341
Type 2 diabetes mellitus with severe nonproliferative diabetic retinopathy without macular edema	E11.349
Type 2 diabetes mellitus with proliferative diabetic retinopathy with macular edema	E11.351
Type 2 diabetes mellitus with proliferative diabetic retinopathy without macular edema	E11.359

Acute follicular conjunctivitis, right eye	H10.011
Acute follicular conjunctivitis, left eye	H10.012
Acute follicular conjunctivitis, bilateral	H10.013
Acute follicular conjunctivitis, unspecified eye	H10.019
Other mucopurulent conjunctivitis, right eye	H10.021
Other mucopurulent conjunctivitis, left eye	H10.022
Other mucopurulent conjunctivitis, bilateral	H10.023
Other mucopurulent conjunctivitis, unspecified eye	H10.029
Acute atopic conjunctivitis, unspecified eye	H10.10
Acute atopic conjunctivitis, right eye	H10.11
Acute atopic conjunctivitis, left eye	H10.12
Acute atopic conjunctivitis, bilateral	H10.13
Acute toxic conjunctivitis, right eye	H10.211
Acute toxic conjunctivitis, left eye	H10.212
Acute toxic conjunctivitis, bilateral	H10.213
Acute toxic conjunctivitis, unspecified eye	H10.219
Pseudomembranous conjunctivitis, right eye	H10.221
Pseudomembranous conjunctivitis, left eye	H10.222
Pseudomembranous conjunctivitis, bilateral	H10.223
Pseudomembranous conjunctivitis, unspecified eye	H10.229
Serous conjunctivitis, except viral, right eye	H10.231

## Disorders of the Conjunctiva

Conjunctivitis refers to any inflammatory condition of the membrane that lines the eyelids and covers the exposed surface of the sclera, and is caused by either a virus or bacteria. Viruses are usually benign and self-limited, but tend to last longer than a bacterial type. Mucopurulent conjunctivitis is often characterized by the discharge of pus in the eye causing morning crusting, which makes it difficult to open the eyes.

The ICD-10-CM code range for disorders of the conjunctiva is H10–H11.

In order to code for disorders of the conjunctiva in ICD-10-CM the following is necessary:

- Type of conjunctivitis
- Laterality
- Acute or chronic

Serous conjunctivitis, except viral, left eye	H10.232
Serous conjunctivitis, except viral, bilateral	H10.233
Serous conjunctivitis, except viral, unspecified eye	H10.239
Unspecified acute conjunctivitis, unspecified eye	H10.30
Unspecified acute conjunctivitis, right eye	H10.31
Unspecified acute conjunctivitis, left eye	H10.32
Unspecified acute conjunctivitis, bilateral	H10.33
Unspecified chronic conjunctivitis, right eye	H10.401
Unspecified chronic conjunctivitis, left eye	H10.402
Unspecified chronic conjunctivitis, bilateral	H10.403
Unspecified chronic conjunctivitis, unspecified eye	H10.409
Chronic giant papillary conjunctivitis, right eye	H10.411
Chronic giant papillary conjunctivitis, left eye	H10.412
Chronic giant papillary conjunctivitis, bilateral	H10.413
Chronic giant papillary conjunctivitis, unspecified eye	H10.419
Simple chronic conjunctivitis, right eye	H10.421
Simple chronic conjunctivitis, left eye	H10.422
Simple chronic conjunctivitis, bilateral	H10.423
Simple chronic conjunctivitis, unspecified eye	H10.429

Chronic follicular conjunctivitis, right eye	H10.431
Chronic follicular conjunctivitis, left eye	H10.432
Chronic follicular conjunctivitis, bilateral	H10.433
Chronic follicular conjunctivitis, unspecified eye	H10.439
Vernal conjunctivitis	H10.44
Other chronic allergic conjunctivitis	H10.45

Currently there are no ICD-10-CM guidelines related to this disease.

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