



# Anisocoria



Courtesy of Scott Haines, M.D.

## What is anisocoria?

**Anisocoria** is a medical term for unequal pupil size. Normally our pupils are relatively the same size. While small differences in pupil size are normal and can even come and go (**physiologic anisocoria**), constant and significant differences in pupil sizes may be a sign of damage to the brain or the nerves that control the pupils.

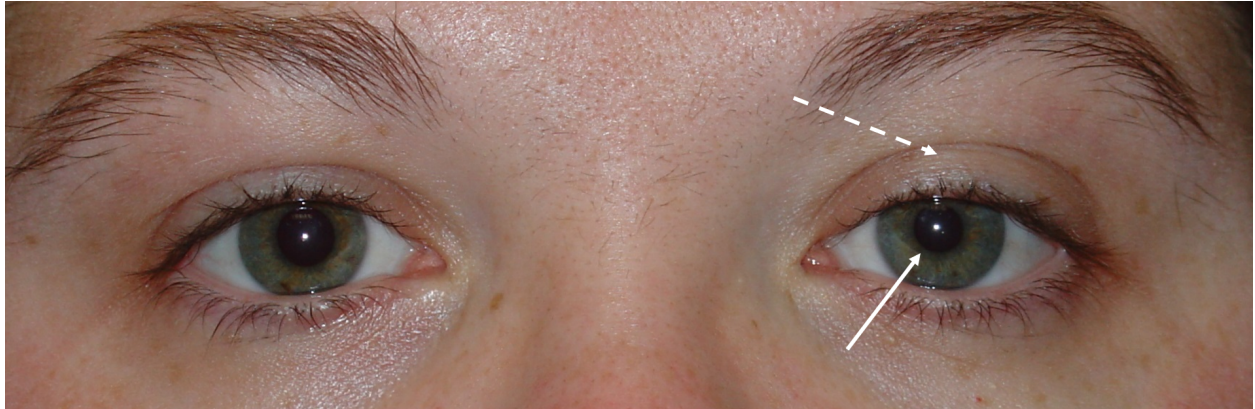
## What causes anisocoria?

Normally, in dim light (such as at night), the pupil dilates (becomes larger) to let in more light to the eyes. In bright light (such as sunlight), the pupil constricts (becomes smaller), which decreases the amount of light getting into the eye. **Problems affecting the muscles or nerves controlling the pupil cause abnormal pupil size.** When this affects one side, the pupil sizes may be unequal.

## Why should I be concerned about anisocoria?

**Anisocoria cannot make you go blind.** Though many causes of anisocoria are benign and some people only notice some blurry vision and/or light sensitivity, **it can be a sign of a serious and potentially life-threatening neurological problem.**

## Horner Syndrome: An Abnormally Small Pupil



Courtesy of Scott Haines, M.D.

**Left Horner syndrome.** The left pupil is smaller (solid arrow) and the left eyelid is droopy (dashed arrow).

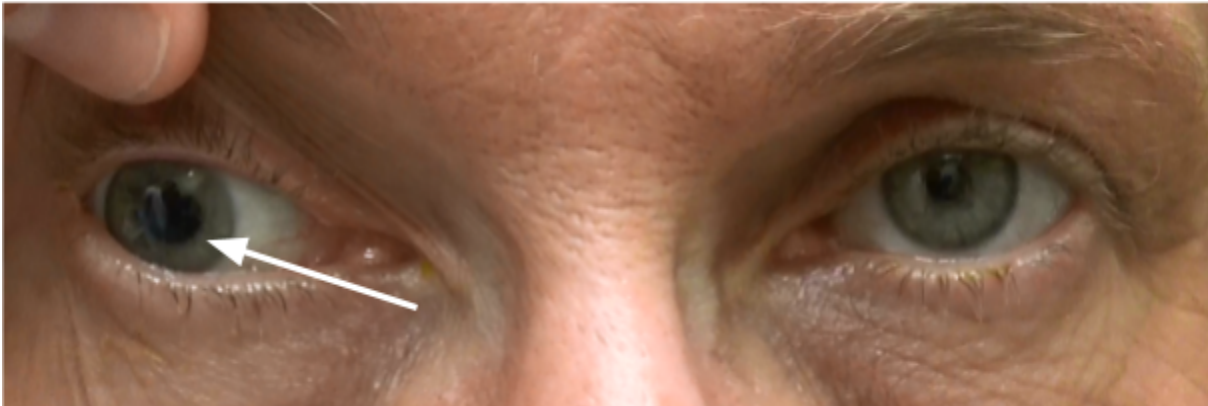
The nerves controlling the muscles that dilate the pupil are part of the **sympathetic (“fight or flight”) nervous system**. These nerves also control the muscles that open your eyelids and activate the sweat glands on your face. **Horner syndrome** occurs when these nerves do not work. **The pupil on the affected side is abnormally small (miosis) and the upper eyelid will droop (ptosis) mildly.** There also may be loss of sweating, especially on the forehead on the same side.

**Horner syndrome does not damage the eye or cause vision loss.** Although there are benign causes that do not usually need treatment, it is important to find out what is causing the Horner syndrome because it *may* be a sign of a life-threatening condition, such as **stroke**, lung, chest or brain **tumor**, or break in the wall of the carotid artery (carotid **dissection**). Experiencing pain in the neck or around the eye, in association with a Horner syndrome, may be a sign of a carotid dissection, and warrants urgent evaluation through the emergency department, since a dissection can lead to a stroke.

## 3<sup>rd</sup> Cranial Nerve Palsy: An Abnormally Large Pupil

The nerves controlling the muscles that constrict the pupil are part of the **parasympathetic nervous system**. **These nerves travel along the 3<sup>rd</sup> cranial nerve**, which comes from the brainstem near the back of your brain and travels forward to your eye. The 3<sup>rd</sup> cranial nerve also controls the muscles that move your eyes up, down, and in, as well as open your eyelid. **Damage**

to the 3<sup>rd</sup> cranial nerve can result in a dilated pupil, droopy eyelid and double vision (when the lid is lifted) because the eye does not move normally. The affected eye can often appear deviated toward the ear and slightly downward. The pupil may or may not be dilated, but if it is, it requires urgent evaluation.



Courtesy of Valerie Biousse, M.D.

**Right 3<sup>rd</sup> cranial nerve palsy.** The right pupil is bigger (arrow) and the right eye is positioned down and out. A finger is holding the right eyelid open because it is so droopy.

**The most concerning cause of a 3<sup>rd</sup> cranial nerve palsy is a brain aneurysm. This is a life-threatening medical emergency because the aneurysm can break open and bleed into the brain.** Other causes of 3<sup>rd</sup> cranial nerve palsy include decreased blood flow to the nerve (**microvascular ischemia**), tumors pressing on the nerve, and inflammation of the nerve. Although these problems can be serious, they may improve with treatment (inflammation), without treatment (microvascular ischemia), or slowly worsen over time (tumor).

Are there other forms of anisocoria that are not dangerous?

**Adie Tonic Pupil: An Abnormally Large Pupil**

An Adie tonic pupil is abnormally large like a 3<sup>rd</sup> cranial nerve palsy, but the pupil still constricts when focusing on something close to the face, and there is no double vision or droopy eyelid. The eyes can move fully in all directions. It may occur after a viral infection, but usually no known cause is found. The pupil may remain large or gradually shrink in size over several years. Patients can note increased light sensitivity and blurriness when reading, but overall no specific

treatment is needed. Your doctor may also find decreased reflexes in your legs but leg weakness does not occur.



**Left Adie tonic pupil.** The left pupil is larger (arrow) and does not react to light.



**Left Adie tonic pupil.** When focusing on the finger up close, the left pupil constricts more strongly (arrow).

Courtesy of Scott Haines, M.D.

## Medications Or Chemicals Causing Anisocoria

There are many medications or chemicals that can cause the pupil to dilate or constrict. While some of these medications are intentionally used in the eye, sometimes these medications or chemicals are accidentally rubbed into the eye from your skin, usually by your finger.

- **Eye drops that dilate the pupil:** atropine, phenylephrine, tropicamide, cyclopentolate, scopolamine
- **Eye drops that constrict the pupil:** pilocarpine, brimonidine
- **Other chemicals that affect the pupils:** pesticides, the ingredients on flea collars, **scopolamine** skin patches for motion sickness, inhalers for asthma, antiperspirant wipes



A pupil that is chemically dilated or constricted will return to normal size and function as the chemical wears off. **Depending on the specific chemical, this can take hours or days.**

## Why do I need to see a neuro-ophthalmologist?

Neuro-ophthalmologists specialize in conditions that cause problems with the pupils. Your doctor will **examine your pupils** in different lighting conditions and perform an **eye and cranial nerve exam**. Because some forms of anisocoria may be present for years before it is noticed, **your doctor may ask you to provide old pictures** to determine how long you have had the problem. **Eye drops** may be used to help diagnose the cause of the anisocoria. Your doctor may order scans of your head and body, such as **MRIs** and/or **CTs**. If these tests find any serious problems, your doctor will refer you to the appropriate specialists for urgent treatment. In other cases, they may recommend treatments for your symptoms, which could involve eye drops or nothing at all.

## Additional Reading/Resources

- **Anisocoria, by the American Academy of Ophthalmology's EyeWiki Project** (<http://eyewiki.org/Anisocoria>)
- **Anisocoria, by Medlineplus** (<http://medlineplus.gov/ency/article/003314.htm>)
- **Anisocoria, University of Florida Health** (<https://ufhealth.org/anisocoria>)

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