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 nerves that control the pupils or to the brain.

What causes anisocoria?

Normally, in dim light (such as at night), the pupil dilates to let in more light to the eyes. In bright light (such as sunlight), the pupil constricts to make the pupils 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

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 and tear 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 may droop (ptosis). Other nerves may also be damaged, causing abnormal sweating, double vision, numbness, difficulty swallowing, or talking.

Horner syndrome does not damage the eye or cause vision loss. However, 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 or chest tumor, or break in the wall of the carotid artery (carotid dissection). There are also benign causes that do not usually need treatment.

3rd 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 3rd cranial nerve, which comes from the brainstem at the back of your head and travels forward to your eye. The 3rd cranial nerve also controls the muscles that move your eyes up, down, and in, as well as open your eyelid. Damage to the 3rd cranial nerve may result in a dilated pupil, droopy eyelid and/or double vision.
**Right 3rd cranial nerve palsy.** The right pupil is bigger (arrow) and the right eye has drifted down and out. A finger is holding the right eyelid up because it does not want to open.

The most concerning cause of a 3rd 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 3rd 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 3rd 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. It may occur after a viral infection or no known cause may be found (idiopathic). The pupil may remain large or gradually shrink in size over several years.

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

- **Eye drops that dilate the pupil**: atropine, phenylephrine, tropicamide, cyclopentolate, scopolamine
- **Eye drops that constrict the pupil**: pilocarpine, brimonidine
- **Other medications that affect the pupils**: pesticides, scopolamine skin patches for motion sickness

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)


This information was developed collaboratively by the Patient Information Committee of the North American Neuro-Ophthalmology Society. This has been written by neuro-ophthalmologists and has been edited, updated, and peer-reviewed by multiple neuro-ophthalmologists. The views expressed in this brochure are of the contributors and not their employers or other organizations. Please note we have made every effort to ensure the content of this is correct at time of publication, but remember that information about the condition and drugs may change. Major revisions are performed on a periodic basis.

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