CONDITION

Tonic pupil syndrome

Tonic pupil syndrome causes one or both pupils to react slowly because their controlling nerves have been damaged.

WHAT IT IS
A pupil that reacts slowly after nerve injury

BODY SYSTEM
Eyes and nervous system

MAIN SYMPTOMS
Unequal pupils, light sensitivity, near blur, slow focus changes

WHAT CAUSES IT
Usually unknown; sometimes nerve injury or another condition

HOW IT IS DIAGNOSED
Pupil examination, near-response testing, sometimes dilute pilocarpine drops

MAIN TREATMENT
Observation, vision aids, and treatment of underlying causes

CAN IT BE CURED?
No - nerve changes usually persist

IS IT AN EMERGENCY?
Sometimes - sudden onset with headache, drooping, or double vision

LONG-TERM OUTLOOK
Usually stable without sight loss; second eye may become affected

Overview

Tonic pupil syndrome is a condition in which one or both pupils respond unusually slowly. The pupil is the dark opening in the centre of the eye. It normally becomes smaller in bright light and larger in dim light.

The affected pupil is often larger than the other pupil at first. It may react little to light but become smaller when you focus on something close. Afterward, it opens again more slowly than usual. This slow, sustained response is why it is called "tonic."

The condition results from damage to part of the parasympathetic nervous system. These nerves control pupil narrowing and help the lens focus on nearby objects. The damage is usually near or behind the eye, in a group of nerve cells called the ciliary ganglion or in the short nerves that leave it.

When a tonic pupil occurs with reduced or absent deep tendon reflexes, particularly at the knee or ankle, it may be called Holmes-Adie syndrome. Some people also have changes in sweating or other automatic body functions.

A confirmed tonic pupil is usually not dangerous and does not normally damage the eye. However, a newly enlarged or unequal pupil can have other causes that need prompt assessment. It is important not to assume that a new pupil change is tonic pupil syndrome without an examination.

Symptoms

The pupil change may be found during an eye examination before it causes any difficulty. When symptoms occur, they may include:

The difference in pupil size is called anisocoria. In tonic pupil syndrome, it is often more noticeable in bright light because the affected pupil does not narrow normally.

The pupil may not move as one smooth circle. Small sections of the coloured iris can contract while other sections remain still. This is known as segmental constriction and is a useful finding during an eye examination.

Near vision may be blurry at first because the same nerve pathway helps the lens focus. Some people notice eye strain, headaches after close work, or a need to hold reading material farther away. Near focusing often improves over time as nerve fibres regrow and adapt, although it may not return completely to normal.

Knee or ankle reflexes may become weaker or disappear. This does not usually cause weakness or prevent normal movement. In some people, reflex changes appear before or after the pupil change.

- One pupil that looks larger than the other
- Sensitivity to bright light or glare
- Blurred vision when reading or doing close work
- Slow adjustment when moving between bright and dim places
- Difficulty changing focus between near and distant objects

Causes and risk factors

In many people, no clear cause is found. The nerve injury may follow a mild inflammatory or

viral illness, but this often cannot be confirmed. Tonic pupil syndrome is generally considered an acquired condition rather than an inherited one.

Possible secondary causes include:

The autonomic nervous system controls automatic functions such as pupil size, sweating, heart rate and digestion. Widespread symptoms involving these functions may suggest that the tonic pupil is part of a broader nerve condition.

Tonic pupil syndrome is more often recognised in younger and middle-aged adults and is reported more often in women. It commonly starts in one eye. The other eye can become affected later, sometimes years afterward.

- Injury or surgery near the eye socket
- Infection affecting the nerves
- Inflammation or autoimmune conditions
- Diabetes or another condition affecting peripheral nerves
- Rare disorders of the autonomic nervous system

Diagnosis

Diagnosis begins with a medical history and an examination of both eyes. The clinician may ask when you first noticed the pupil change, whether it developed suddenly, and whether you have pain, double vision, eyelid drooping or other neurological symptoms.

The examination usually checks:

A tonic pupil typically responds poorly to light but narrows more clearly during sustained near focusing. It then enlarges slowly when near focusing stops. Early in the condition, the near response may also be weak.

Dilute pilocarpine eye drops may support the diagnosis. Pilocarpine stimulates the muscle that narrows the pupil. After denervation, the affected muscle can become unusually sensitive and constrict in response to a weak solution. This test is not perfect: it may be negative early on, and other nerve problems can also produce sensitivity.

Blood tests or scans are not routinely needed when the examination shows a typical isolated tonic pupil. They may be considered if both eyes are affected, the pattern is unusual, or there are signs of infection, inflammation, widespread nerve damage or another neurological condition.

- Pupil size in bright and dim light

- The response of each pupil to light
- Pupil narrowing while focusing on a nearby object
- Eye movements and eyelid position
- Near and distance vision
- The iris under magnification
- Knee and ankle reflexes

Treatment and management

Many people do not need treatment once the diagnosis has been confirmed. Management is based on how much the pupil and focusing changes affect daily life.

Reading glasses can help with near blur. The strength may need adjustment as focusing improves or changes over time. If one eye is affected, a different lens strength may be needed for each eye.

Tinted glasses or sunglasses can reduce glare and light sensitivity. A tinted or specially designed contact lens may make the pupil difference less noticeable and reduce excess light entering the eye. Contact lenses require proper fitting and eye-care advice.

Pilocarpine drops can make the pupil smaller and may improve some symptoms. They are not suitable or helpful for everyone. They can cause brow ache, dimmer vision in low light and focusing changes, so they should only be used after an eye specialist has discussed the benefits and drawbacks.

If another condition caused the nerve injury, treatment focuses on that condition when possible. Treating an underlying cause does not always restore normal pupil function because damaged nerve fibres may remain altered.

Reduced tendon reflexes usually do not require treatment when they are not causing other problems. New weakness, numbness, balance problems or widespread changes in sweating need separate assessment.

Complications

Tonic pupil syndrome itself rarely threatens sight. The main ongoing problems are glare, cosmetic concern and difficulty focusing on close objects.

Reduced near focusing may interfere with reading, screen use or detailed work, especially

early in the condition. Corrective lenses often reduce this difficulty.

Over time, abnormal nerve regrowth can connect focusing fibres to the pupil muscle. This helps explain why the pupil responds better to near effort than to light. It may also cause a persistently slow response rather than restoring normal movement.

The affected pupil can gradually become smaller. In someone who has had the condition for years, it may eventually be smaller than the other pupil. This change does not necessarily mean that the condition is worsening.

A second tonic pupil may develop later. Rarely, tonic pupils occur with broader autonomic nerve problems, such as reduced sweating. These additional symptoms matter because they may require further investigation.

Prevention

There is no known way to prevent the usual form of tonic pupil syndrome because the cause is often unknown.

Some secondary cases follow an identifiable injury, infection or other nerve condition, but they cannot always be prevented. Protecting your eyes from physical injury is sensible, although it does not prevent unexplained tonic pupil syndrome.

Regular eye checks do not prevent the condition. They can help document pupil changes, update reading lenses and make sure that new symptoms have not developed for another reason.

Living with it and what to expect

Tonic pupil syndrome is usually long-lasting. The pupil may never regain a normal light response, but symptoms can become less noticeable as the eye adapts.

Near focusing is often most troublesome early on. It may improve over several months or years as surviving nerve fibres regrow and form new connections. Reading glasses may still be useful, particularly as normal age-related focusing changes develop.

The difference between the pupils may also change. The affected pupil often begins larger and slowly becomes smaller over the years. The appearance can therefore become less obvious, stay noticeable or occasionally reverse so that the affected pupil is the smaller one.

A second eye can become involved later, but this does not happen to everyone. Follow-up may be advised if symptoms change, both pupils become affected, or there are signs involving

reflexes, sweating or other nerve functions.

Most people can continue normal work, exercise and daily activities. Sunglasses, suitable reading correction and extra time for the eyes to adjust between different lighting conditions may help. The condition does not usually shorten life or lead to blindness.

When to get medical help

Arrange a routine eye appointment if you have a gradual or longstanding difference in pupil size, persistent light sensitivity, or trouble focusing up close. An examination can confirm the pattern and check for other causes.

Seek urgent medical assessment for a new or suddenly noticed unequal pupil, particularly if its cause is unknown. Although tonic pupil syndrome is usually harmless once confirmed, several other conditions can cause a similar appearance.

Call emergency services if a pupil change occurs with:

Get same-day urgent eye care for sudden loss of vision or a red, severely painful eye, especially with nausea, vomiting or coloured halos around lights. These are not typical features of tonic pupil syndrome.

If you already have a confirmed tonic pupil, arrange follow-up rather than emergency care for gradual changes such as increasing reading difficulty or slowly changing pupil size. New neurological symptoms still need prompt assessment.

- A sudden severe headache
- New double vision or abnormal eye movement
- A newly drooping eyelid
- Weakness, numbness, confusion or difficulty speaking
- Collapse or a recent significant head injury

Common questions

Is a tonic pupil the same as Adie syndrome?

The terms overlap. An isolated pupil with the characteristic slow response is often called a tonic pupil or Adie pupil. Holmes-Adie syndrome usually refers to a tonic pupil together with reduced or absent tendon reflexes.

Will my pupil return to normal?

The nerve changes usually persist, so the light response may not become fully normal. Near focusing can improve, and the pupil often becomes smaller over time. The visible difference between the eyes may therefore become less noticeable.

Can tonic pupil syndrome make me blind?

An uncomplicated tonic pupil does not usually damage the retina, optic nerve or other structures needed for sight. It can cause glare and near blur, but these are different from permanent loss of vision. Sudden vision loss is not typical and needs urgent assessment.

Why does my pupil react when I look at something close but not to light?

After the original nerve injury, regrowing fibres may reconnect unevenly. Fibres involved in near focusing can reach the pupil muscle, producing a stronger response to close work than to light. This is called light-near dissociation.

Can tonic pupil syndrome spread to the other eye?

The condition does not spread like an infection. However, the same underlying nerve process can affect the second eye later. This may happen months or years after the first eye is affected, but many people continue to have only one tonic pupil.

Do I need regular scans or blood tests?

Not usually when the eye examination shows a typical isolated tonic pupil and there are no other concerning symptoms. Further tests may be appropriate if the onset or examination is unusual, both eyes are involved, or there are signs of a wider neurological or autonomic condition.

Sources

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