



Leber Hereditary Optic Neuropathy

What is Leber Hereditary Optic Neuropathy (LHON)?

Leber hereditary optic neuropathy (LHON) is a genetic disease that almost exclusively affects the optic nerves, leading to vision loss (with both eyes eventually affected). In LHON, **one of the genes that controls energy production in the optic nerves is abnormal**, and over time the waste products of that energy production begin to damage the optic nerves. The abnormal gene is found in the DNA that exists in our mitochondria, the parts of our cells that control energy production, not in the DNA that makes up our chromosomes in the nucleus.

People with LHON experience sudden, painless, rapidly progressive visual loss in either both eyes, or **in one eye, followed by similar vision loss in the other eye weeks or even months later**. Vision loss usually involves the center part of vision and can be severe, but total blindness is extremely rare. In many patients, the back of the eye, including the optic nerve head (the part of the optic nerve that can be seen) **can look completely normal at first**, which can make the diagnosis very challenging for doctors. Although the vision loss is typically permanent, there are some people (4-37%) who will recover some of their vision, depending on the specific mutation in the mitochondrial DNA. Rarely, people with LHON will also have other problems, which may include heart rhythm problems, muscle spasms, or brain problems (encephalopathy).

There are many mitochondrial gene defects that can cause LHON, although most people (90%) have one of three mitochondrial DNA gene mutations, referred to as the 3 primary mutations.

Who Can Get LHON?

Most people with LHON are between 15-35 years old, however, it can affect people in other age groups. It is more common in men. About 25-50% of male carriers and 10% of female carriers of the genetic defect will develop visual loss from LHON. Habits and activities that increase the body's energy and waste-removal needs (such as smoking, poor nutrition, heavy binge drinking of alcohol, etc.) can worsen or even trigger the onset of visual loss. Because LHON is a genetic disease, people with family members who have unexplained vision loss may have the disease.

Because all mitochondrial DNA comes from mothers, **LHON is passed down through mothers and men cannot pass the disease to their children.**

How is LHON Diagnosed?

Before genetic testing was available, doctors would diagnose people with LHON if someone had unexplained central vision loss from optic nerve dysfunction in both eyes, with normal testing (brain scans and lab tests) and the history of vision loss was very suspicious for LHON or there were family members with similar vision loss. There is now genetic testing available for LHON that can confirm the presence or absence of the mitochondrial DNA mutations from a blood sample or swab of the gums (“buccal swab”). If none of the 3 primary gene defects are present, labs can do a more detailed evaluation to detect less common mitochondrial DNA mutations by sequencing the entire mitochondrial genome.

How is LHON Treated?

Until recently, there were very few treatments available for LHON. Researchers have looked at many different treatments, including an antioxidant called idebenone (related to coenzyme Q). Idebenone supplementation (900 mg per day) has been found to be well tolerated, safe and results in mild improvement or at least stabilization of vision in some patients, especially if used in the first year of visual loss.

Since 2015, gene therapy by an injection into the eye has been studied as a method of treating LHON patients who have the most common mitochondrial DNA mutation (11778). Preliminary results have been promising, but research is ongoing and the treatment is not yet available outside of a research trial.

What Should I Do About My Condition?

Your doctor will follow you closely while your vision is declining and may recommend that you take idebenone. Once your vision is stable, your doctor will begin to extend follow-up visits. Your doctor may recommend that you refrain from certain activities, such as smoking or heavy alcohol consumption.

Your doctor may recommend that you obtain an EKG (electrocardiogram), which looks at your heart rhythm to make sure that you do not have any abnormalities. This may be obtained through your primary care provider.

Your doctor may also talk with you about a **low vision evaluation** or visiting **visual rehabilitation** services. These centers use devices and lifestyle modifications to help maximize the vision you still have. Although there may be some out-of-pocket expenses with these services, they may be able to help improve your quality of life during this difficult transition.

There are also support groups available for people with LHON. Although LHON is rare, you do not have to suffer alone. A link to one of the major support groups is listed below.

Other Resources

- **National Library of Medicine (patient-oriented article on LHON):**
 - <https://ghr.nlm.nih.gov/condition/leber-hereditary-optic-neuropathy>
- **GeneReviews (textbook article on LHON - very technical):**
 - <http://www.ncbi.nlm.nih.gov/books/NBK1174/>
- **Rare diseases article on LHON (also very technical):**
 - <https://rarediseases.org/rare-diseases/leber-hereditary-optic-neuropathy>
- **LHON.org (support group):**
 - <http://www.lhon.org>
- **Data Collection Program website for affected and carriers of LHON:**
 - <https://lhon.rare-x.org>

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