

# About Retinopathy of Prematurity (ROP)

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## What is retinopathy of prematurity?

Retinopathy of prematurity (ROP) is a potentially blinding eye disorder that primarily affects premature infants weighing about 2¾ pounds (1250 grams) or less that are born before 31 weeks of gestation (A full-term pregnancy has a gestation of 38–42 weeks). The smaller a baby is at birth, the more likely that baby is to develop ROP. This disorder—which usually develops in both eyes—is one of the most common causes of visual loss in childhood and can lead to lifelong vision impairment and blindness. ROP was first diagnosed in 1942.

## How many infants have retinopathy of prematurity?

Today, with advances in neonatal care, smaller and more premature infants are being saved. These infants are at a much higher risk for ROP. Not all babies who are premature develop ROP. There are approximately 3.9 million infants born in the U.S. each year; of those, about 28,000 weigh 2¾ pounds or less. About 14,000–16,000 of these infants are affected by some degree of ROP. The disease improves and leaves no permanent damage in milder cases of ROP. About 90 percent of all infants with ROP are in the milder category and do not need treatment. However, infants with more severe disease can develop impaired vision or even blindness. About 1,100–1,500 infants annually develop ROP that is severe enough to require medical treatment. About 400–600 infants each year in the US become legally blind from ROP.

## Are there different stages of ROP?

Yes. ROP is classified in five stages, ranging from mild (stage I) to severe (stage V):

**Stage I** — Mildly abnormal blood vessel growth. Many children who develop stage I improve with no treatment and eventually develop normal vision. The disease resolves on its own without further progression.

**Stage II** — Moderately abnormal blood vessel growth. Many children who develop stage II improve with no treatment and eventually develop normal vision. The disease resolves on its own without further progression.

**Stage III** — Severely abnormal blood vessel growth. The abnormal blood vessels grow toward the center of the eye instead of following their normal growth pattern along the surface of the retina. Some infants who develop stage III improve with no treatment and eventually develop normal vision. However, when infants have a certain degree of Stage III and "plus disease" develops, treatment is considered. "Plus disease" means that the blood vessels of the retina have become enlarged and twisted, indicating a worsening of the disease. Treatment at this point has a good chance of preventing retinal detachment.

**Stage IV** — Partially detached retina. Traction from the scar produced by bleeding, abnormal vessels pulls the retina away from the wall of the eye.

**Stage V** — Completely detached retina and the end stage of the disease. If the eye is left alone at this stage, the baby can have severe visual impairment and even blindness.

Most babies who develop ROP have stages I or II. However, in a small number of babies, ROP worsens, sometimes very rapidly. Untreated ROP threatens to destroy vision.

## Can ROP cause other complications?

Yes. Infants with ROP are considered to be at higher risk for developing certain eye problems later in life, such as retinal detachment, myopia (nearsightedness), strabismus (crossed eyes), amblyopia (lazy eye), and glaucoma. In many cases, these eye problems can be treated or controlled.

## What causes ROP?

ROP occurs when abnormal blood vessels grow and spread throughout the retina, the tissue that lines the back of the eye. These abnormal blood vessels are fragile and can leak, scarring the retina and pulling it out of position. This causes a retinal detachment. Retinal detachment is the main cause of visual impairment and blindness in ROP.

Several complex factors may be responsible for the development of ROP. The eye starts to develop at about 16 weeks of pregnancy, when the blood vessels of the retina begin to form at the optic nerve in the back of the eye. The blood vessels grow gradually toward the edges of the developing retina, supplying oxygen and nutrients. During the last 12 weeks of a pregnancy, the eye develops rapidly. When a baby is born full-term, the retinal blood vessel growth is mostly complete (The retina usually finishes growing a few weeks to a month after birth). But if a baby is born prematurely, before these blood vessels have reached the edges of the retina, normal vessel growth may stop. The edges of the retina—the periphery—may not get enough oxygen and nutrients.

Scientists believe that the periphery of the retina then sends out signals to other areas of the retina for nourishment. As a result, new abnormal vessels begin to grow. These new blood vessels are fragile and weak and can bleed, leading to retinal scarring. When these scars shrink, they pull on the retina, causing it to detach from the back of the eye.

## Are there other risk factors for ROP?

In addition to birth weight and how early a baby is born, other factors contributing to the risk of ROP include anemia, blood transfusions, respiratory distress, breathing difficulties, and the overall health of the infant.

An ROP epidemic occurred in the 1940s and early 1950s when hospital nurseries began using excessively high levels of oxygen in incubators to save the lives of premature infants. During this time, ROP was the leading cause of blindness in children in the US. In 1954, scientists funded by the National Institutes of Health determined that the relatively high levels of oxygen routinely given to premature infants at that time were an important risk factor, and that reducing the level of oxygen given to premature babies reduced the incidence of ROP. With newer technology and methods to monitor the oxygen levels of infants, oxygen use as a risk factor has diminished in importance.

## Treatment

### How is ROP treated?

The most effective proven treatments for ROP are laser therapy or cryotherapy. Laser therapy "burns away" the periphery of the retina, which has no normal blood vessels. With cryotherapy, physicians use an instrument that generates freezing temperatures to briefly touch spots on the surface of the eye that overlie the periphery of the retina. Both laser treatment and cryotherapy destroy the peripheral areas of the retina, slowing or reversing the abnormal growth of blood vessels. Unfortunately, the treatments also destroy some side vision. This is done to save the most important part of our sight—the sharp, central vision we need for "straight ahead" activities such as reading, sewing, and driving.

Both laser treatments and cryotherapy are performed only on infants with advanced ROP, particularly stage III with "plus disease." Both treatments are considered invasive surgeries on the eye, and doctors don't know the long-term side effects of each.

In the later stages of ROP, other treatment options include:

- *Scleral buckle.* This involves placing a silicone band around the eye and tightening it. This keeps the vitreous gel from pulling on the scar tissue and allows the retina to flatten back down onto the wall of the eye. Infants who have had a sclera buckle need to have the band removed months or years later, since the eye continues to grow; otherwise they will become nearsighted. Sclera buckles are usually performed on infants with stage IV or V.
- *Vitrectomy.* Vitrectomy involves removing the vitreous and replacing it with a saline solution. After the vitreous has been removed, the scar tissue on the retina can be peeled back or cut away, allowing the retina to relax and lay back down against the eye wall. Vitrectomy is performed only at stage V.

## What happens if treatment does not work?

While ROP treatment decreases the chances for vision loss, it does not always prevent it. Not all babies respond to ROP treatment, and the disease may get worse. If treatment for ROP does not work, a retinal detachment may develop. Often, only part of the retina detaches (stage IV). When this happens, no further treatments may be needed, since a partial detachment may remain the same or go away without treatment. However, in some instances, physicians may recommend treatment to try to prevent further advancement of the retinal detachment (stage V). If the center of the retina or the entire retina detaches, central vision is threatened, and surgery may be recommended to reattach the retina.

## Current Research

### What research is being done?

The Cryotherapy for Retinopathy of Prematurity (CRYO-ROP)-Outcome Study of Cryotherapy for Retinopathy of Prematurity Study examined the safety and effectiveness of cryotherapy (freezing treatment) of the peripheral retina in reducing the risk of blindness in certain low birth-weight infants with ROP. Follow-up results confirm that applying a freezing treatment to the eyes of premature babies with ROP helps save their sight. The follow-up results also give researchers more information about how well the babies can see in the years after cryotherapy.

The Effects of Light Reduction on Retinopathy of Prematurity (Light-ROP) Study evaluated the effect of ambient light reduction on the incidence of ROP. The study determined that light reduction has no effect on the development of a potentially blinding eye disorder in low birth weight infants. The study determined that light reduction in hospital nurseries has no effect on the development of ROP.

The Supplemental Therapeutic Oxygen for Prethreshold Retinopathy of Prematurity (the STOP-ROP) Multicenter Trial tested the efficacy, safety, and costs of providing supplemental oxygen in moderately severe retinopathy of prematurity (prethreshold ROP). Results showed that modest supplemental oxygen given to premature infants with moderate cases of ROP may not significantly improve ROP, but definitely does not make it worse.

The Early Treatment for Retinopathy of Prematurity Study (ETROP) is designed to determine whether earlier treatment in carefully selected cases of ROP will result in an overall better visual outcome than treatment at the conventional disease threshold point used in the CRYO-ROP study.