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# DIABETES

## A Threat to your vision

### The Eye

The eye is like a camera. When you take a picture, the lens in the front of the camera allows light through and focuses that light on the film that covers the back inside wall of the camera. When the light hits the film, a picture is taken.

The eye works in much the same way. The front parts of the eye (cornea, pupil and lens) are clear and allow light to pass through. The light also passes through a large space in the center of the eye called the vitreous cavity. The light is then focused on a thin layer of tissue called the retina, which covers the back inside wall of the eye.

### The Retina

The Retina is like the film in a camera. It is the seeing tissue of the eye. When the focused light hits the retina, a picture is taken. Messages about this picture are sent to the brain through the optic nerve. This is how we see.

The retina has two parts: the peripheral retina and the macula. If you imagine the retina as a circle with a bull's-eye at the center, the macula, like the bull's-eye, is very small. The large area of the retina that surrounds the macula and makes up 95% of the retina is called the peripheral retina.

The peripheral retina gives us vision to the side, called peripheral vision. It is this part of the retina that is at work when we see something out of the corner of the eye.

In order to see fine detail, you must look straight ahead, using the macula. The macula is the centre of the retina. Even though the macula makes up only a small part of the retina, it is one hundred times more sensitive to detail than the peripheral retina.

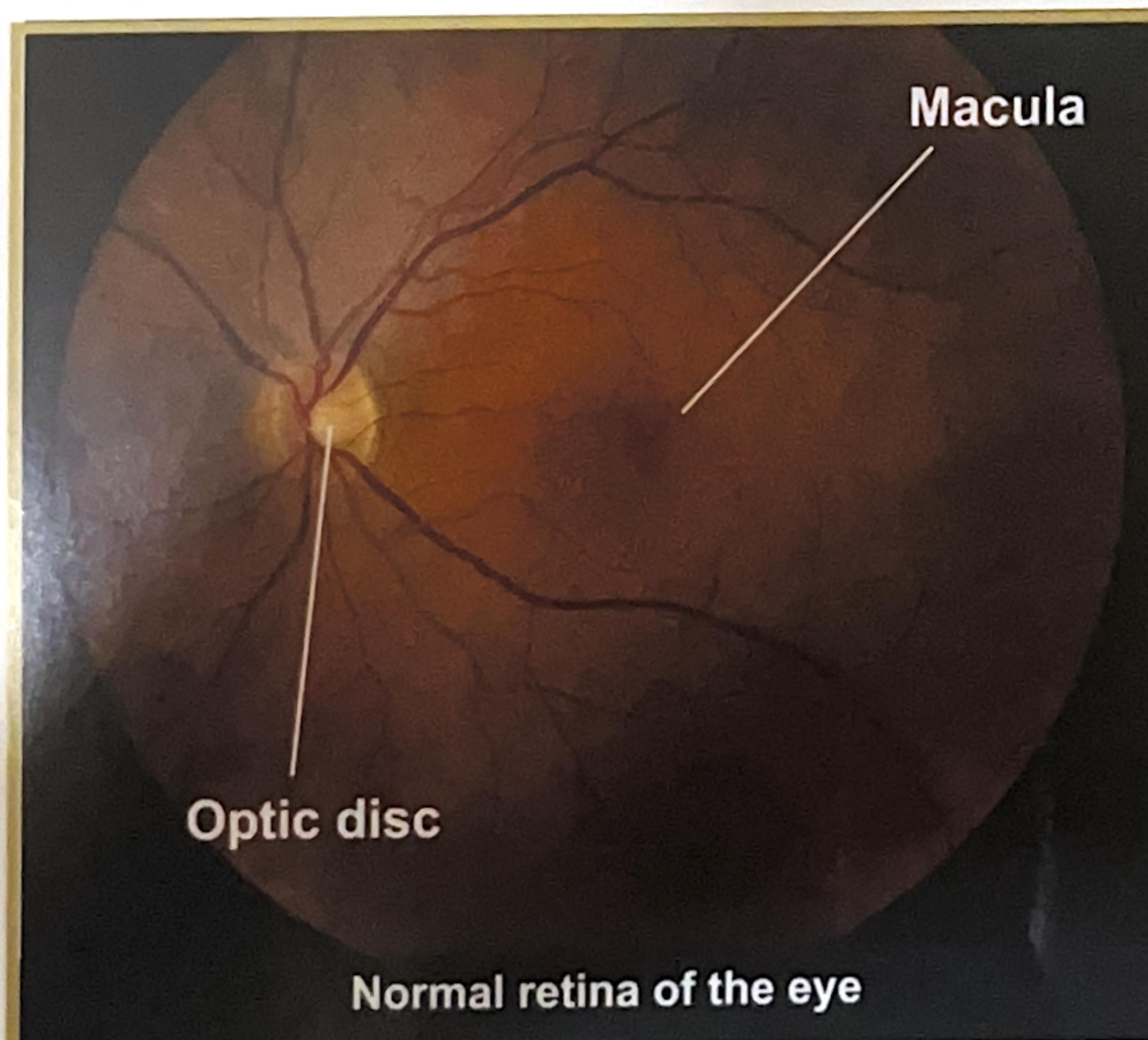
Because of its extreme complexity, the retina is very vulnerable. It consumes oxygen and blood sugar glucose at higher rates than any other tissue.

Because these substances are supplied by the circulatory system the amount of blood flow per unit time, per gram of tissue is also the greatest in the body. Therefore any disorder that interferes with the blood supply can do severe damage.

Thus diabetes which is the inability of the body to produce energy by processing sugars affects the blood stream and therefore the retina.

### Diabetic Retinopathy

In diabetes etinopathy, the blood vessels of the retina become abnormal and cause the problems that diabetic patients have with their eyesight.



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## **Background Diabetic Retinopathy (BDR)**

Normally, the blood vessels in the retina do not leak. But with diabetes, the retinal blood vessels can develop tiny leaks. These leaks cause fluid or blood to seep into the retina. The retina then becomes wet and swollen and cannot work properly. This is called background (or non proliferative) diabetic retinopathy (BDR or NPDR).

## **Proliferative Diabetic Retinopathy (PDR)**

Another problem with the retinal blood vessels in diabetes is that they can close. The retinal tissue, which depends on those vessels for nutrition, will no longer work properly. The areas of the retina in which the blood vessels have closed then foster the growth of abnormal new blood vessels. This can cause bleeding and scar tissue that can result in total loss of vision.

This form of diabetic retinopathy in which abnormal new blood vessels grow (or proliferate) is called proliferative diabetic retinopathy (PDR).

## **Lasers in Diabetic Retinopathy**

Laser surgery can be very helpful for the treatment of diabetic retinopathy. The laser beam is a high-energy light that turns to heat when it is focused on the parts of the retina to be treated.

As early as 1949, ophthalmologists attempted to burn the tissues away with beams of sunlight focused through a complicated optical system. Later, various other powerful light sources were used for this so-called photocoagulation, but no other instrument can match the laser for intensity and precision of its beam.

The laser treatment does not affect the outer eye. The physician uses drops to widen pupil, then aims the beam through the open pupil directly at the retina. The beam passes through the transparent cornea without heating the tissue, just like sunlight passes through a clear window without heating the glass.

In background diabetic retinopathy (BDR), the laser heat either seals the leaking blood vessels of the macula or reduces their leakage and allows the macula to dry.

In proliferative diabetic retinopathy (PDR), the laser destroys the diseased portions of the retina to stop the growth of new blood vessels.

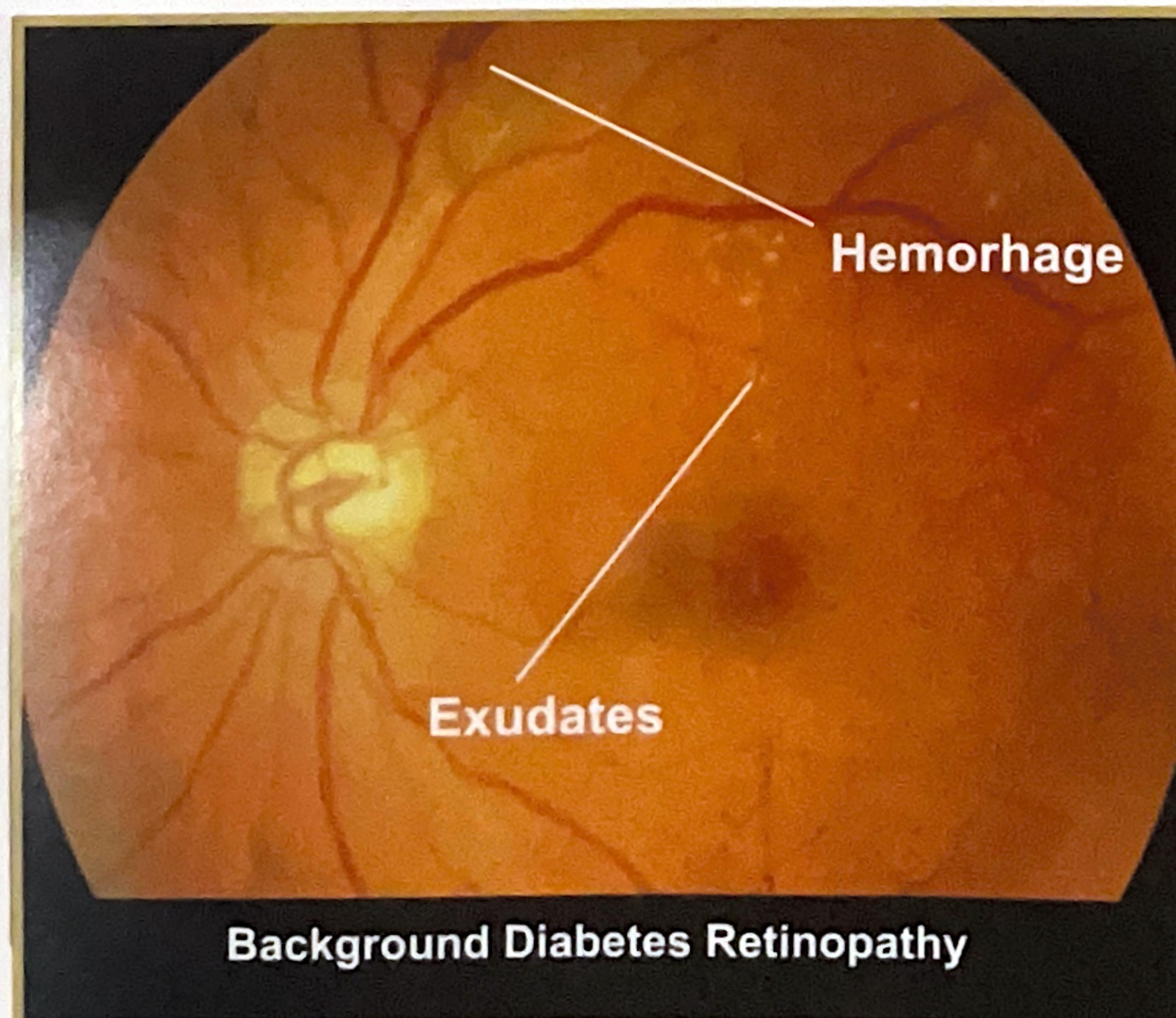
Initially a special test called fluorescein angiography may be done. To do the test, dye is injected into a vein in the patient's arm. The dye travels throughout the body, including the eyes.

With a special camera and a flash, photographs of the retina are taken as the dye passes through it. The photographs will show what kinds of changes have occurred in the retina.

## **Lasers in BDR**

There are two types of laser treatment for non proliferative diabetic retinopathy-focal (or specific) treatment, and grid treatment. With focal treatment, the specific leaking spots in the retina are found by a fluorescein angiogram, which is then used as a guide for the laser in an attempt to stop the leakage.

In some cases of non proliferative diabetic retinopathy, blood vessels appear to be leaking everywhere in the macula and not just in a few specific areas. In such cases, a scatter of argon laser photocoagulation in a grid pattern is placed across the entire wet macular area.



**Retina blood vessels develop tiny leaks**  
**These leaks cause fluid (exudates) or blood (hemorrhage) to seep into the retina** The retina then becomes wet and swollen and cannot work properly

## **Lasers in PDR**

If the amount of new vessels is great, laser treatment can often prevent loss of vision. The type of laser treatment that is done when there are a lot of vessels is called pan-retinal photocoagulation.

This type of laser treatment is usually done in two or more separate sessions. The idea is to use the laser to destroy all of the dead areas of retina where the blood vessels have been closed. When these areas are treated with the laser, the retina stops manufacturing new blood vessels, and those that are already present tend to diminish or disappear.

Today diabetic retinopathy is one of the most frequently diagnosed disorders of the retina.

Before the advent of insulin therapy, diabetic retinopathy was virtually unknown, as patients usually died before the disease affected the eyes.

Today, not only is the treatment for diabetes so successful, retinopathy can also be successfully treated using lasers.

A cure however depends on catching the ailment early.

And that is the crux of the problem.

### **Diabetic Retinopathy - Complications that harm your eyes**

Unfortunately, the complications caused by diabetes do not end with background and proliferative diabetic retinopathy. If it were so, ophthalmologists might not see so much havoc wrought by diabetes. As one retina specialist at Sankara Nethralaya remarked, "As it is, since most diabetics are unaware of the possible complications, they do not take frequent eye tests. This results in severe damage to the eye long before it makes itself known as deteriorating vision".

In more cases than not, the villain is the new blood vessels that develop in proliferative retinopathy. This new vessel growth is the retina's method of coping with the closing of its own blood vessels and the loss of nourishment.

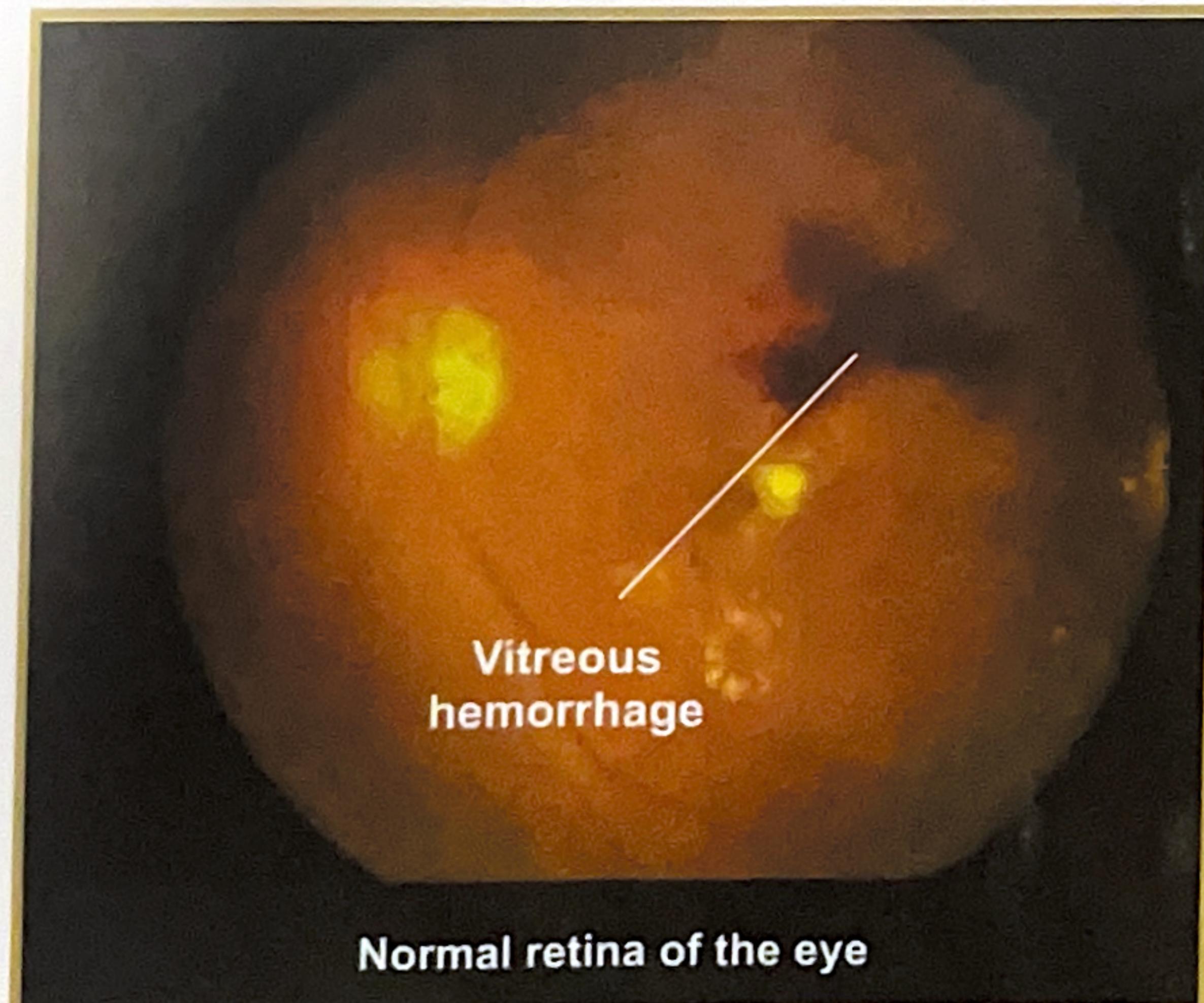
But the problem is that when new blood vessels do develop, they are never any good; they are, in fact, dangerous to the eye. They do not nourish the retina properly, and they may cause other problems.

One problem is bleeding into the vitreous cavity - called vitreous hemorrhage. A second problem is the growth of scar tissue on the retina that can pull the retina off the back wall of the eye - called a traction retinal detachment.

A third problem occurs when the abnormal new blood vessels grow on the iris, the colored part of the eye, rather than just on the retina. This condition is called rubeosis. When these blood vessels grow on the iris, they may close off the normal flow of fluid out of the eye and cause the pressure in the eye to rise. The high pressure, called neovascular glaucoma sometimes causes permanent changes, resulting in visual loss, pain, and even loss of the eye.

It is very important to understand that the closing of retinal blood vessels and the growth of new blood vessels may occur without any noticeable change of vision. When vitreous hemorrhage occurs, there is a sudden blurring of vision and the appearance of spots that look like strings, spiderwebs, or insects that seem to float in front of the eye. It is often helpful for the patient who develops a vitreous hemorrhage to remain in a sitting position so that gravity can help settle the blood to the lower parts of the vitreous cavity.

Once the blood settles, panretinal laser photocoagulation can be done. Laser cannot make the blood disappear, but it can prevent more bleeding. The vitreous hemorrhage that is present usually disappears with time.



**In proliferative diabetic retinopathy the villain is the development of fragile new blood vessels. They can rupture leading to bleeding into the cavity of the eye - vitreous hemorrhage.**

If there is so much vitreous hemorrhage that laser treatment is not possible or if the blood does not disappear on its own, it can be removed with an operation called a vitrectomy. The blood-filled vitreous gel is removed. It is replaced during the operation with a clear fluid that is compatible with the eye. Overtime, this fluid is absorbed by the eye and is replaced by the eye's own fluid, although the eye does not replace the gel itself. The lack of vitreous gel does not affect the function of the eye.

When a retinal detachment occurs, the patient will notice a shadow very large dark area in the vision. When the retinal detachment extends to the macula, the dark shadow will be straight ahead and vision will be very poor. The abnormal new blood vessels and scar tissue also can cause visual loss because they can wrinkle the retina.

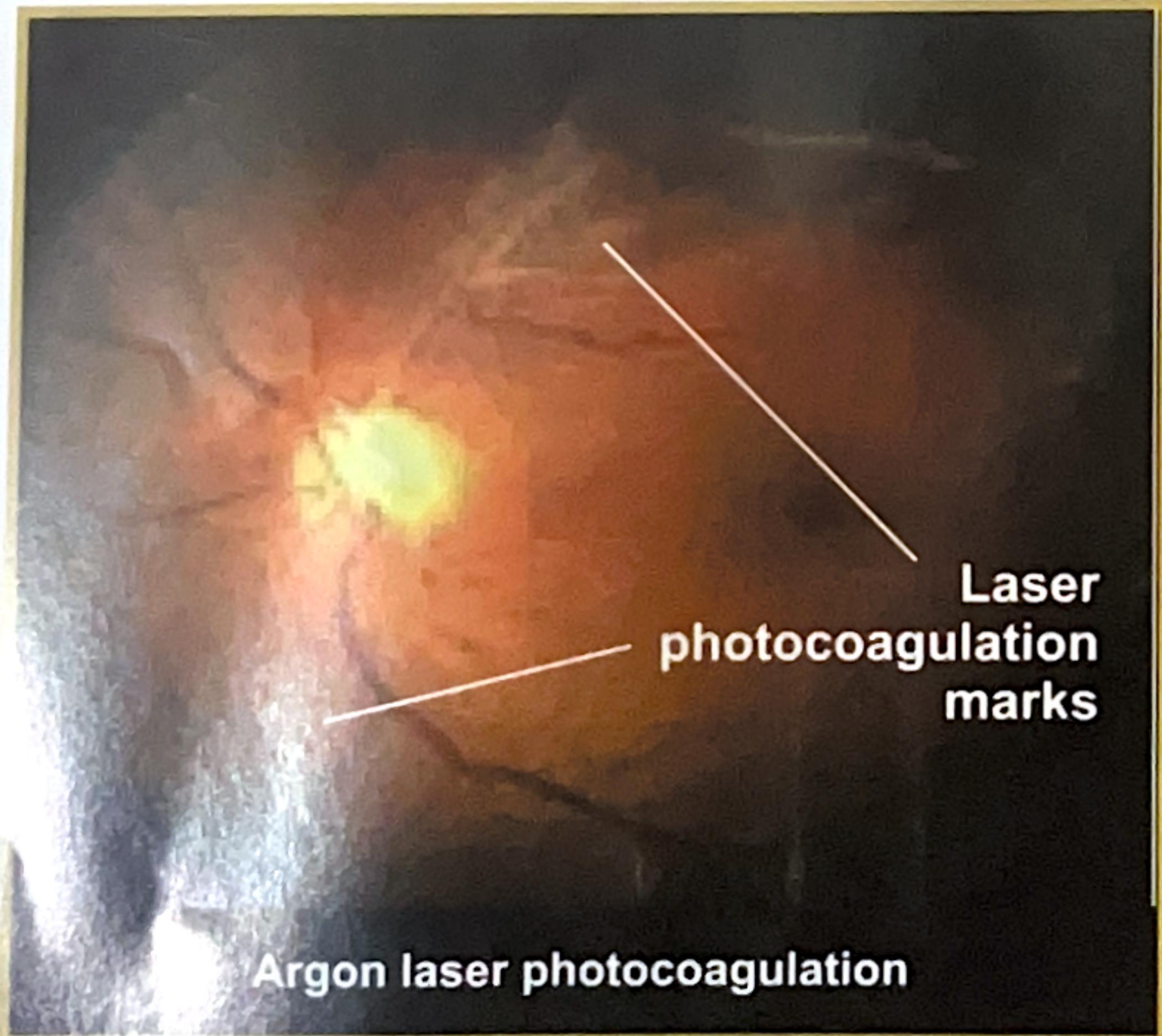
The only way the patient can regain any vision is for the retina to be reattached and the blood vessels and scar tissue to be removed from the surface of the retina. This is accomplished by vitrectomy surgery. The surgeon removes the vitreous gel from the eye so that it stops pulling on the retina and the traction can be released. The surgeon may remove the scar tissue from the surface of the retina so that there is no wrinkling of the retina. The detached and wrinkled retina should flatten and smooth out.

Lasers may be used to prevent late development of abnormal new vessels and rubeosis. The surgeons also laser inside the eye to seal any tears of the retina. If there are tears in the retina, the surgeon places a large air bubble in the eye to press the retina completely against the back wall of the eye while the laser treatment takes hold. In time, the air bubble will disappear and be replaced by the eye's own fluid.

"What is important is to remember that once retinopathy starts, even the control of blood sugar will not stop it. This makes it vital for people to have an eye examination once a year not just when their sugar is high but even when it has been controlled."

# Remember

**Diabetic Retinopathy often has no early warning signals. Even in advanced cases, it may progress a long way without any symptoms. Hence regular eye examinations for all diabetics is a must.**



**Argon laser photocoagulation (visible as grayish patches and spots in this picture) is a treatment by which a high-energy light turns to heat when it is focused on the parts of the retina to be treated.**