



RVO

Don't give the eye 'stroke' a fighting chance

Retinal vein occlusion

Information for patients
and relatives

 **NOVARTIS**



Imprint

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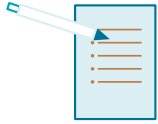
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Focussing on the eye as a sense organ

The **human eye** works like a **state-of-the-art camera**. Whereas a small digital camera weighs at least 100 grams and thus takes sharp pictures, less than 10 grams are enough for our eyes to achieve technically far more impressive results. A healthy human eye distinguishes over **600,000 shades of colour** and takes in more than **10 million pieces of information** per second which it passes on to the brain!



How vision works

When we look at something, for example a flower, the light rays reflected from this flower reach the **cornea**. Incoming light is bundled by the cornea and passes through to the **iris**. The iris works like a camera's aperture. In dark conditions, the transparent centre (**pupil**) expands, and in bright conditions it contracts. The **lens** behind the iris regulates near and distant vision and loses its elasticity with increasing age. The consequence is presbyopia.

After passing through the cornea, pupil and lens, the beam of light travels through the **vitreous humour** to the **retina**, on which the photoreceptors are located and in the centre of the retina, the **area specialised for high-acuity vision (macula)**.

Well over than 100 million **photoreceptors** convert light into nerve impulses that the **optic nerve** transmits to the brain, thus enabling us to see the flower we are looking at. The photoreceptors known as **cones** are responsible for colour vision, and the **rods** for perceiving lower and higher intensity light. Roughly 95 per cent of the photoreceptors are located in the **macula**.



Retinopathies: when the retina becomes damaged

In technical terms, diseases of the retina are called **retinopathies**. Vascular diseases of the eye often lead to retinal diseases. This is due to the approximately 130 million photoreceptors that react very sensitively to supply bottlenecks. Disturbances in their metabolism can cause irreversible damage and endanger vision. The most well-known vascular diseases of the eye include **diabetic retinopathies** and **retinal vein occlusions**.

Risks from retinopathies

After diabetic retinopathies, **retinal vein occlusions** (RVO) represent the **second most common vascular disease** of the eye. While diabetic retinopathy is caused by high blood glucose levels and affects the vision of almost every diabetic patient for decades, there are **several risk factors** for retinal vein occlusion (see pages 20–24). Retinal artery occlusions, on the other hand, are rather rare.

Examinations by an ophthalmologist

Specialists in ophthalmology diagnose eye diseases using various methods, e.g.:

› measuring visual acuity/visual function

eye charts (letters, numbers, objects) from a distance of 5 m (distant visual acuity) or reading texts from a distance of 30–40 cm (near visual acuity)

› examining retinal and vascular changes

Reflection of the ocular fundus (back of the eye) with a special mirror in which the pupils are dilated with drops for this purpose

› examining the anterior eye areas

Viewing the eye with a slit lamp (slit-shaped beam of light) connected to a microscope



Eye emergency: retinal vein occlusions

In retinal vein occlusion, a **blood vessel in the eye** is completely or partially **blocked**, for example, by a blood clot (thrombus) or by calcification of hardened arteries pressing on a vein.

The consequence: the blood can **no longer flow unhindered** through the veins, **congestion** occurs and the **supply of nutrients and oxygen** to the retina **suffers**. This increases the pressure in the vessels, from which more fluid escapes.

The consequences are, for example, retinal bleeding or accumulation of fluid in the retina.

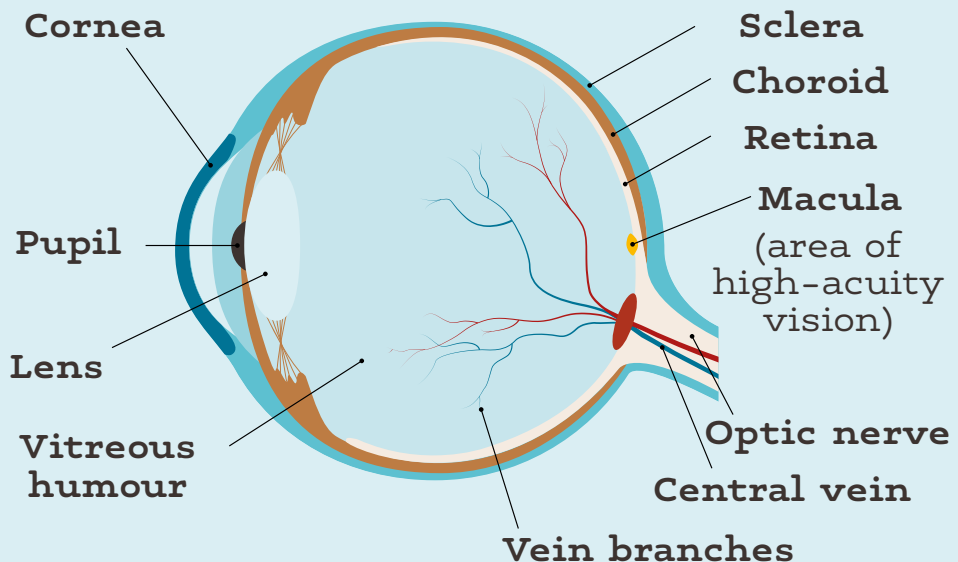
As it progresses,

- further **accumulation of fluid** can occur (for example in the area of the sharpest vision = macular oedema) and
- new blood vessels that have developed due to the **insufficient supply** to the retina can further restrict the ability to see and make symptoms worse. In severe cases, this can lead to a risk of blindness.

Impairment of vision overnight

Retinal vein occlusion often occurs **at night**. The reason: the arterial blood pressure usually decreases during sleep. At the same time, the pressure in the eye veins increases when lying down.

When **waking up in the morning**, those affected then notice **slight to severe restrictions** in their vision, which often recede somewhat in the course of the day but can have long-term consequences.

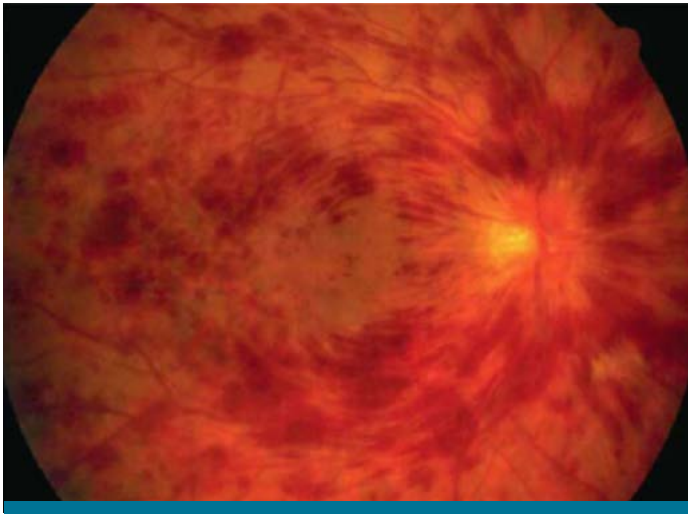


Different forms and manifestations

Ophthalmologists classify retinal vein occlusions according to whether the occlusion affects the **central vein** (central retinal vein occlusion: CRVO) or a **branch of a vein** (branch retinal vein occlusion: BRVO).

Central retinal vein occlusion (= CRVO)

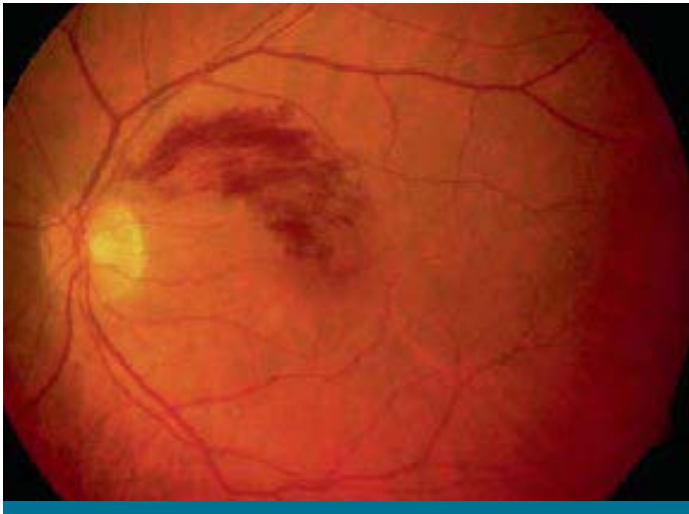
A central retinal vein occlusion occurs in the **blind spot** a natural bottleneck in the retina. This is because that is where the **entrance and exit for the optic nerve, the central vein and the central artery** of the eye are located.



Branch retinal vein occlusion (= BRVO)

A branch retinal vein occlusion almost always occurs in areas where **veins and arteries cross in the eye**. Branch retinal vein occlusion is over **5 times more common** than central retinal vein occlusion and is less likely to result in loss of visual function.

The extent to which vision suffers in the long term also depends on whether the **vein closes completely or only partially** and how severe the loss of vision is immediately after the vein closes.



The case of insufficient blood flow

In addition to the location of the occurrence, the **severity** of central retinal vein occlusion also **plays a role** in the course of the disease. Healthcare professionals base this on the **size of the area** that was insufficiently supplied with blood or not supplied at all due to the vein occlusion (**degree of ischaemia**). The larger this area is the greater the risk that undesirable new blood vessels prone to bleeding will form (**neovascularisation**).

Ischaemic occlusion: a question of proportions

Optic nerve head
(papilla)



Area of loss in
circulation due to
ischaemic occlusion



The role of VEGF

VEGF (Vascular Endothelial Growth Factor) is a **growth factor** with important tasks, such as renewing blood vessels.

It has a negative effect on **macular oedema caused by retinal vein occlusion**. In such cases, this growth factor promotes the formation of **new, undesirable and diseased blood vessels**. VEGF also increases the vascular permeability and thus the **risk of oedema** in the eye.

A fatal vicious circle

The more diseased blood vessels develop, the higher the risk that further **haemorrhages or oedemas** will occur from these **vessels**, which will eventually **become fragile**. If the loss of blood flow due to retinal vein occlusion affects an area more than 10 times the diameter of the optic nerve head (papilla), an **ischaemic occlusion** occurs.

This type of ischaemia can occur throughout the retina: frequently in the **periphery**, i.e. in the outer areas of the retina, less frequently in the central field of vision.

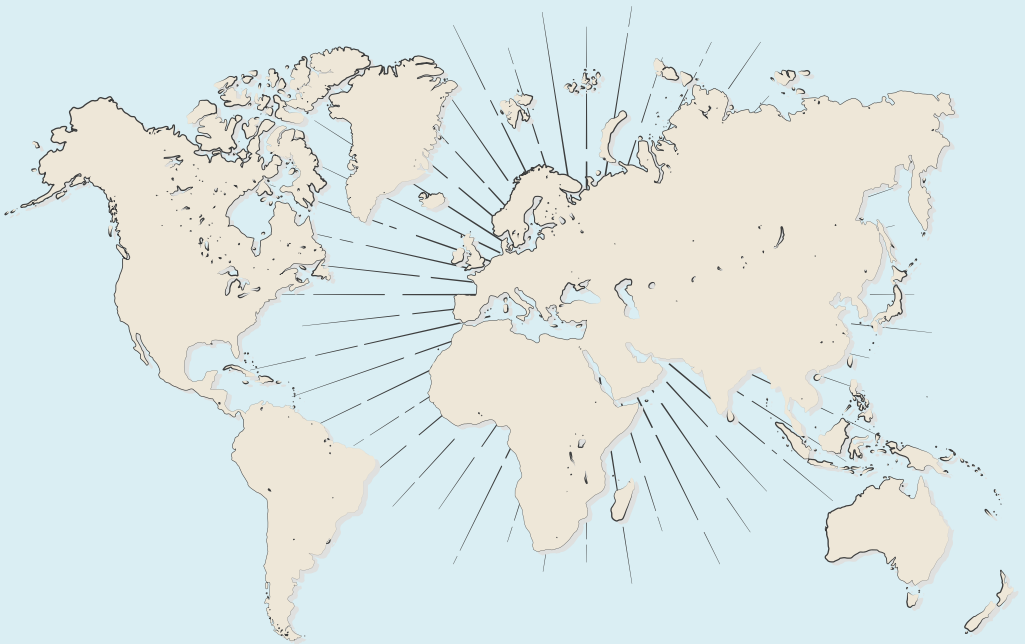


Facts and figures on retinal vein occlusion

- › Roughly **28 million people** worldwide suffer from retinal vein occlusion, a good 23 million (83.3%) from CRVO, and just under 5 million (16.7%) from BRVO.
- › RVO occur most frequently between the ages of **60 to 70 years** in women and men alike.
- › However, there are also younger patients in which the risk of RVO **increases with age**. Retinal vein retinal vein occlusion occurs predominantly in men before the age of 50.
- › 5–12% of all patients with RVO also develop the disease in the **other eye** within the following **five years**.

Worldwide

approx. **28 million**
patients who suffer from
retinal vein occlusion.



E

Impaired vision

Retinal vein occlusions lead to a **loss of visual acuity**, and the affected person's vision becomes blurred. **Macular oedema** develops in **more than one-fourth** of patients with branch retinal vein occlusion and more than one-third of patients with central retinal vein occlusion. Fluid accumulation and retinal thickening occur in the area of the eye with the sharpest vision. Characteristic of macular oedema: patients have a 'grey curtain' in their field of vision.

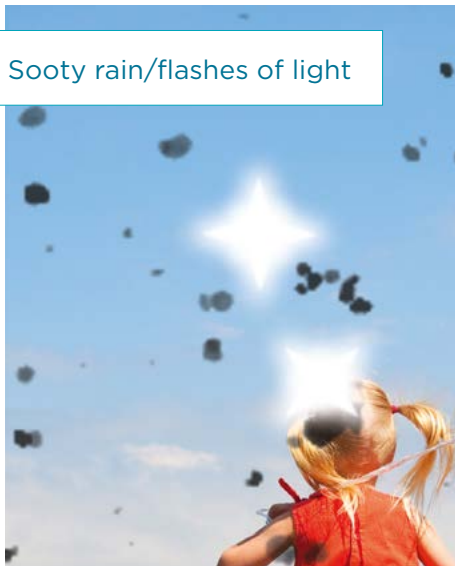
Lower quality of life

Retinal vein occlusions significantly reduce a patients' quality of life, with **central retinal vein occlusions** representing a **greater burden** than branch retinal vein occlusions.

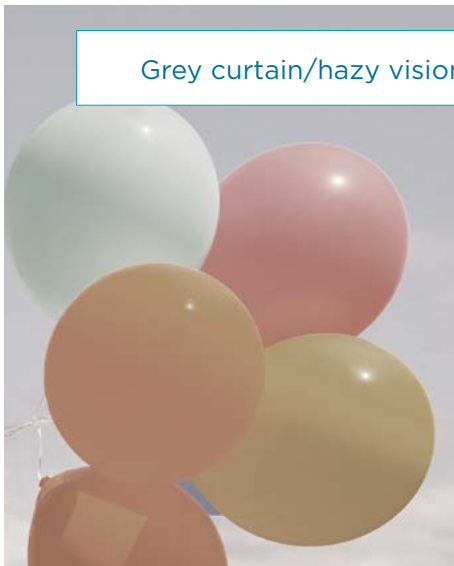
Day-to-day life suffers

The more severe the visual impairment, the more daily life suffers. The fact that they are no longer able to drive a car is a particularly difficult for those affected, and many complain of psychological problems.

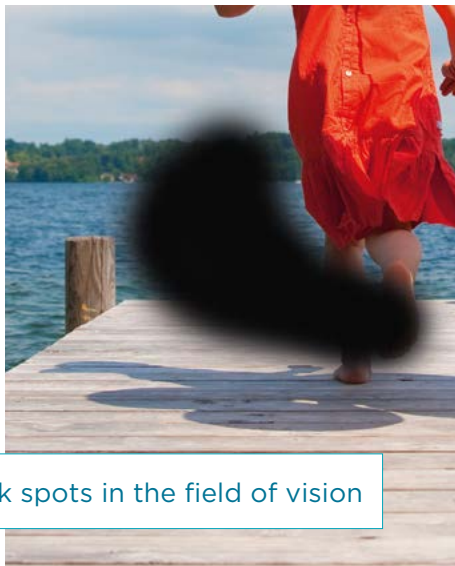
Sooty rain/flashes of light



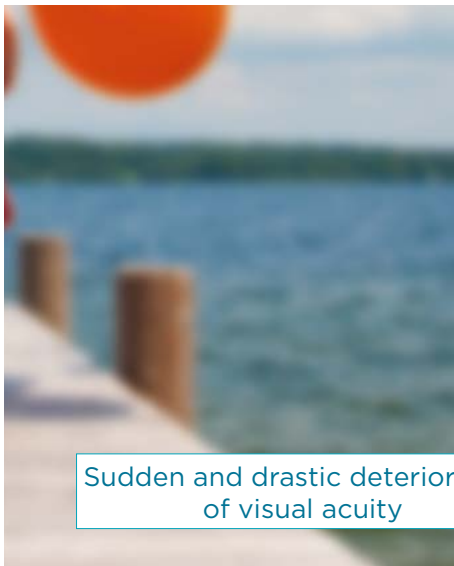
Grey curtain/hazy vision



Dark spots in the field of vision



Sudden and drastic deterioration of visual acuity





Dangers to veins in the eyes

Eye experts are still unable to explain exactly why retinal vein occlusion occurs. However, they know that there are **several factors** that significantly increase the risk of such a 'stroke in the eye'. On the one hand, these include various organic diseases (**systemic risk factors**) such as cardiovascular diseases or changes in blood count. On the other hand, these also include **local risk factors** such as injuries to the eye or eye diseases (e.g. glaucoma). Concomitant diseases are particularly common in CRVO.

Cardiovascular and vascular diseases

Patients with **cardiovascular risks**, such as previous heart attack or stroke, are far more than twice as likely to develop retinal vein occlusion (RVO). High blood pressure is the greatest risk.

High blood pressure (arterial hypertension)

More than half of the German population over the age of 20 lives with high blood pressure, of which around 60 per cent are men and 50 per cent women. Levels **above 140/90 mmHg** are considered **high blood pressure**. Slightly elevated levels can often be reduced by changes in lifestyle (sport, diet), but permanently significantly higher levels require **treatment with medication** and regular medical check-ups. **Risk:** high blood pressure increases the risk of RVO by almost threefold!

Diabetes mellitus

There are well **over 7 million diabetes patients** in Germany. Nine out of ten of them have type 2 diabetes which usually only becomes noticeable after the age of 50. Tablets and a healthy lifestyle determine the treatment which later sometimes also includes insulin. **Risk:** people with diabetes also have a significantly increased risk of developing retinal vein occlusion.

Lipometabolic disorders (dyslipidaemias)

Lipometabolic disorders are a common ailment: roughly 65 per cent of the German population suffers from it. However, only slightly less than half know about this and the associated risk of a **hardening of the arteries** (arteriosclerosis) and **heart attack**.

The desirable target ranges of the of the various blood lipid levels depend on whether and how many other factors for cardiovascular risk are present.

Risk: a lipometabolic disorder is present in 30–60 percent of all RVO patients.

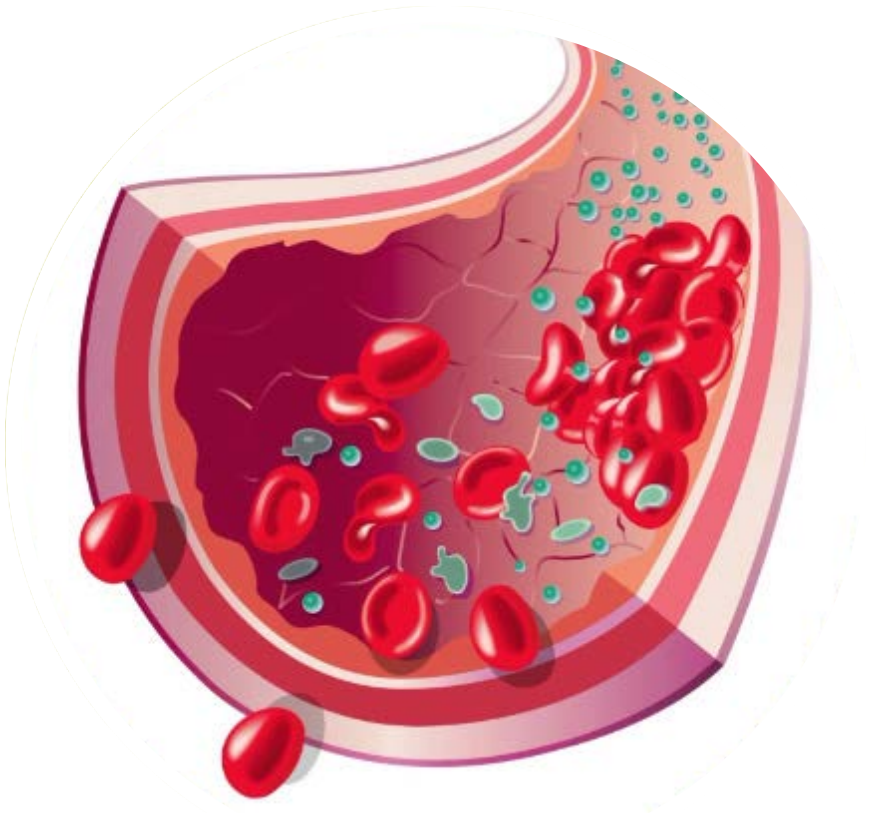
Coronary heart disease (CHD)

In the age group 65+ some 18 per cent of women and 28 per cent of men in this country have **coronary heart disease** – a narrowing of the coronary arteries that carries a high risk of heart attack. The causes of CHD include severe overweight (obesity), high blood pressure, lipometabolic disorders, diabetes and nicotine (smoking).

Risk: 22–50 per cent of all RVO patients suffer from CHD.

Changes in blood count

Certain anomalies in the blood count and **blood clotting disorders** that lead to increased 'clotting' of the blood can also increase the risk of retinal vein occlusion.



Eye disorders

Local risk factors that affect the eye itself seem to exclusively **favour central retinal vein occlusion**, in contrast to the factors mentioned so far. This includes, above all, **glaucoma** which causes almost 2,000 people in Germany to go blind each year. Central retinal vein occlusion occurs in almost **one in ten patients with glaucoma** (8 per cent). Vice versa: glaucoma occurs in seven out of ten patients with central retinal vein occlusion. Some injuries also increase the risk of central retinal vein occlusion.



For your eyes' sake: take prevention seriously

Regular preventive medical check-ups help to identify possible health risk factors at an early stage. Particularly important for vision and RVO prophylaxis are:

› regular check-ups by your ophthalmologist

Patients with diabetes: **at least once a year**, more often if necessary. Everyone over the age of 40: annual glaucoma screening (currently not a statutory health insurance service but is recommended by ophthalmological societies!)

› check-up by a general practitioner for everyone over the age of 35

General health check-up for everyone over 35 years of age at 3-year intervals (including blood pressure, blood lipid and blood sugar checks)

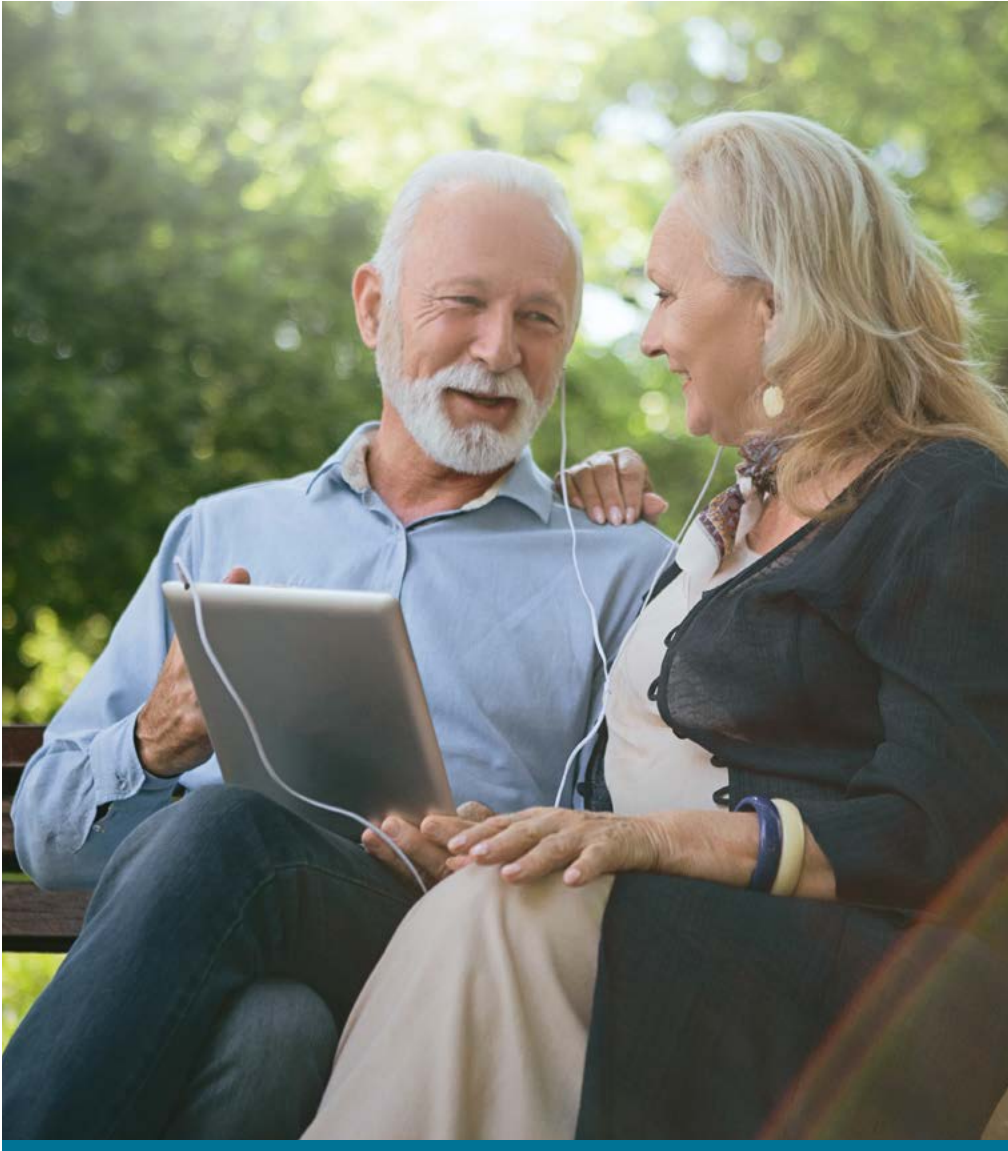


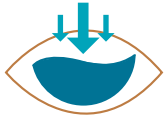
Focussing on diagnostics

Anyone at increased risk of retinal vein occlusion should make an **appointment with an ophthalmologist once a year**. Patients with diabetes who are particularly prone to retinopathy and/or macular oedema, should have **more frequent check-ups** (see also our brochure “Keeping an eye on your eyes with diabetes” which you can download by scanning the corresponding QR code located on the back page). Ophthalmologists advise people over 40 to have an **annual glaucoma screening**. This includes measuring **intraocular pressure**, which is painless yet currently not covered in the range of services provided by statutory health insurance.

Detecting retinal vein occlusions

The ophthalmologist can detect RVO and determine its severity using various examination methods. These include examinations with a special lamp (**slit lamp**), **fluorescence angiography** to visualise the retinal vessels and check **visual acuity** as well as **pupillary reflexes**. Sometimes a **blood test (coagulation diagnostics)** is also performed.





Better vision with the proper treatment

“**Reduce the risks**” is the basic principle in the treatment of retinal vein occlusion. This does not improve limited vision, but it does **reduce the risk of further occlusion**. Good target levels for blood pressure, blood sugar, blood lipid levels and intraocular pressure including giving up smoking therefore form an important basis of the treatment.

Many methods for better vision

The earlier retinal vein occlusion is diagnosed and the less time it takes until treatment, the better the chances of treatment.

Injections with a VEGF inhibitor

When treating retinal vein occlusion, your ophthalmologist will in most cases use **VEGF inhibitors**. According to ophthalmological societies, they are the first drug of choice. For this purpose, the ophthalmologist injects the substance with drops directly into the vitreous humour of the eye under local anaesthesia (= eye injection). This treatment is repeated at regular intervals.

How VEGF inhibitors work

The abbreviation VEGF refers to a **growth factor** (vascular endothelial growth factor) which generally plays a **key role in forming new blood vessels**. This factor promotes vascular permeability in the retina and thus the accumulation of fluid (oedema) – **in the later course** even the formation of **undesirable blood vessels**. Patients with macular oedema caused by retinal vein occlusion exhibit increased levels of VEGF.

VEGF inhibitors block this growth factor and reduce its **harmful effect**. This can **prevent** the leakage of fluid into the retina and subsequent diseased **growth of new vessels**. In this way, VEGF inhibitors can help preserve and, in many cases, improve your vision with early and continuous treatment.

Cortisone treatments

Cortisone treatments (steroid treatments) in the eye are also performed by eye injection. Ophthalmologists inject cortisone implants, which have a depot effect, under local anaesthesia in the form of drops into the vitreous humour of the eye.

According to recent studies, the cortisone preparations used in RVO therapy can increase intraocular pressure. This is considered a major cause of glaucoma.

Patients who have already been diagnosed with glaucoma should not receive eye injections with cortisone, according to the opinion of ophthalmological societies.

For all these reasons, cortisone treatment is considered a “**second-line treatment**” and, according to the German ophthalmological societies, should only be used when the desired therapeutic goal cannot be achieved with VEGF inhibitors or in case of repeated vein occlusions occurring in the eye.





Laser treatments

Laser procedures such as **GRID laser coagulation** targeted (focal) laser treatments are mainly considered when new, diseased blood vessels have formed in the peripheral areas of the retina due to **branch retinal vein occlusion (BRVO)**.

However, they are not suitable for treating **central retinal vein occlusion (CRVO)** the German ophthalmological societies emphasise in their treatment recommendations for retinal vein occlusion. Laser treatment of the ischaemic areas in the peripheral regions of the retina can be performed on both types of occlusion.

Using the concentrated beam of light, the doctor can **shrink undesirable new blood vessels, block leaking blood vessels** and destroy retinal cells. For this reason, this treatment **cannot be repeated as often as desired**.

Laser treatment causes less VEGF to be produced and can help prevent further vision loss, among other things. Generally speaking, this treatment does not lead to improved vision, especially if macular oedema is present.



Living healthy - for the eyes' sake

Prevention is better than cure. There is a lot of truth in this old saying. This is because retinal vein occlusion usually cannot be completely cured despite all the treatment options available. This makes it all the more important to keep the risk for an RVO as low as possible. You can play a major role in shaping this prevention programme with regular exercise, a healthy diet and giving up smoking.

Hands off the cancer sticks

Smoking not only damages the heart and respiratory tract but also the eyes. This is because nicotine constricts the blood vessels and promotes arteriosclerosis. This reduces the blood supply to the retina and can cause damage.

Very dangerous for diabetes and high blood pressure

In the case of diabetes and high blood pressure, high blood sugar or blood pressure levels endanger the fine vessels in the eyes and kidneys. Nicotine is a vascular toxin that further increases the risk of eye and kidney diseases.

Help for giving up smoking

Quitting smoking is difficult for many people. Getting off nicotine often works better with special smoking cessation programmes. Nicotine replacement products such as patches or chewing gum can also help. You can find support here:

› The German Cancer Research Center (DKFZ)

Search for providers of smoking cessation courses and more:

www.anbieter-raucherberatung.de

www.rauchfrei-info.de

› Federal Centre for Health Education (BZgA)

Free telephone advice:

+49 (0)800 8313131

www.bzga.de



A feast for the eyes

The eyes also benefit from a healthy diet. Those who do not consume more calories than necessary, eat a lot of fibre from fruit, vegetables and whole grain products and eat little sugar and animal fats (exception: fatty sea fish with its valuable omega-3 fatty acids), you've come to the right place. This type of mix of nutrients has been shown to have a positive effect on blood pressure, blood sugar and blood lipid levels and thus on several RVO risk factors at the same time: high blood pressure (hypertension), lipometabolic disorders, diabetes and severe overweight (obesity).

Vitamins for eyesight

Beta-carotene, a plant precursor of the 'eye vitamin' A, plays a part in the visual process and a deficiency leads to night blindness. Good sources: e.g. carrots, broccoli, peppers, mango, spinach. Two other carotenoids, zeaxanthin and lutein, protect the eyes from harmful UV rays. Good sources are e.g. maize, egg yolk, orange juice. For lutein in particular: pumpkin, spinach, green peppers. For zeaxanthin in particular: red grapes.

Cell protection from the kitchen

Aggressive oxygen compounds, **free radicals**, damage healthy cells, including those of the eyes. These reactive substances are produced in the body by smoking or sunlight, among other things.

Various **vitamins and minerals** can intercept free radicals, for example, **vitamin A** (e.g. in milk, tomatoes), **vitamin C** (e.g. in citrus and berry fruits), and **vitamin E** (e.g. in germ oils, nuts).

Equally good radical interceptors are the trace elements **zinc** (e.g. in wheat germ, sunflower seeds) and **selenium** (e.g. in fish, cereals).



Keep an eye on your weight

Severe obesity (BMI > 30) drives up blood pressure and blood sugar and thus poses a risk to the eyes.

How to calculate your body mass index (BMI):

Formula
$$\frac{\text{Body weight in kg}}{(\text{height in m})^2}$$

Sample BMI
$$\frac{70 \text{ kg}}{1.70 \text{ m} \times 1.70 \text{ m}} = 24.22 \text{ kg/m}^2$$



Normal weight:
Values between 18.5 and 24.99 kg/m²

Keep moving

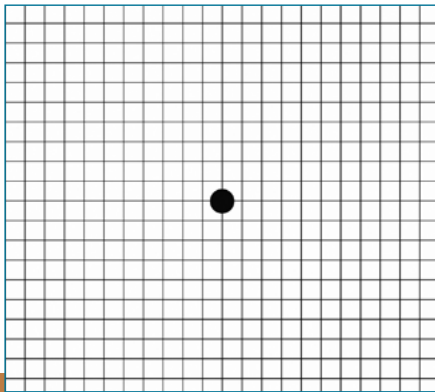
A rolling stone gathers no moss. The importance of regular **physical activity** for health was also shown by a scientific study with over 20,000 participants. Result: those who **exercised at least 4 hours per week** had better vascular had better vascular function and thus a lower risk for heart, circulation and vessels. Therefore, keep moving, for example with brisk walks, walking or cycling or swimming. These have been proven to have a positive effect on obesity, high blood pressure and diabetes and thus also indirectly on eye health.

Overcome your weaker self

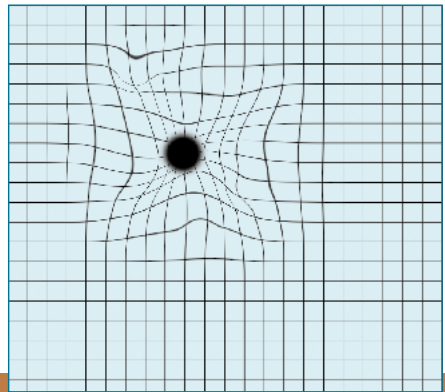
Numerous studies have proven how much a healthy diet, regular physical activity and giving up cigarettes can bring. Self-help groups or special courses help to make your own life healthier and not to fall back into old habits.

Vision test on your own initiative

Please perform this simple test once a month from the age of 50 (does not replace the recommended annual visit to the ophthalmologist from 50!).



Normal vision



Dark spot/distorted vision

The chequered square (Amsler Grid) required for the test and a description have been enclosed with this brochure.

It can be **reordered by telephone** by ringing **+49 (0)911 27312100**.



Helpful addresses and websites

- › **Blickpunkt Auge –
Rat und Hilfe bei Sehverlust**
www.blickpunkt-auge.de/kontakt.html

- › **Deutscher Blinden- und
Sehbehindertenverband e. V. (DBSV)**
Rungestraße 19, 10179 Berlin, Germany
Telephone: +49 (0)30 285387-0
info@dbsv.org
www.dbsv.org

- › **PRO RETINA Deutschland e. V.**
Kaiserstraße 1 c, 53113 Bonn, Germany
Telephone: +49 (0)228 227217-0
info@pro-retina.de
www.pro-retina.de

- › **Stiftung Auge der DOG –
Deutsche Ophthalmologische Gesellschaft e. V.**
Platenstraße 1, 80336 Munich, Germany
Telephone: +49 (0)89 5505768-28
info@stiftung-auge.de
www.stiftung-auge.de

› **Internet**

www.augeninfo.de

www.ratgeber-makula.de

› **Deutscher Diabetiker Bund e. V.**

Käthe-Niederkirchner-Straße 16, 10407

Berlin, Germany

Telephone: +49 (0)30 42082498-0

info@diabetikerbund.de

www.diabetikerbund.de

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Berliner Straße 46, 69120 Heidelberg, Germany

Telephone: +49 (0)6221 58855-0

info@hochdruckliga.de

www.hochdruckliga.de

› **Lipid-Liga e. V.**

Mörfelder Landstraße 72,

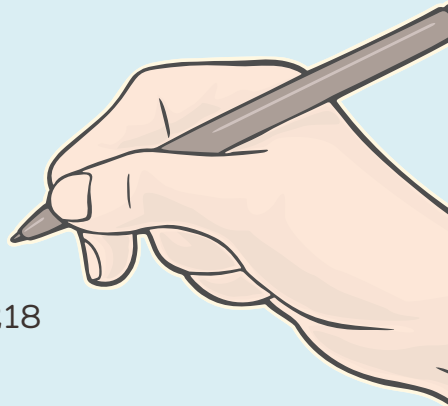
60598 Frankfurt am Main,

Germany

Telephone: +49 (0)69 96365218

info@lipid-liga.de

www.lipid-liga.de



To learn more, please visit:
www.ratgeber-makula.de



The brochures can also be downloaded by scanning the corresponding QR code here:



RVV brochure



DME brochure