Guidelines for diagnosis and treatment of diabetic retinopathy

Czech Ophthalmology Society of Czech Medical Association of J.E. Purkyně, Czech Diabetes Society of Czech Medical Association of J.E. Purkyně
Czech Vitreoretinal Society.

On behalf of the Czech Ophthalmology Society and Czech Vitreoretinal Society: B. Kalvodová, T. Sosna, J. Řehák, P. Kolář, J. Ernest and Š. Pitrová
On behalf of the Czech Diabetes Society: T. Pelikánová, M. Kvapil and J. Škrha

1. CHARACTERISTICS OF DIABETIC RETINOPATHY

Diabetic retinopathy (DR) is a typical microvascular complication of diabetes mellitus (DM). It occurs on the basis of specific morphological changes which are a consequence of a metabolic defect in patients suffering from types 1 and 2 DM. DR may also be accompanied by other specific types of DM. In advanced countries DR and its complications are the most frequent cause of newly occurring blindness in persons aged 20-74 years.

Amongst the clearly confirmed risk factors of DR are the duration of DM, chronic hyperglycaemia, hypertension and the presence of nephropathy. Complex preventive and therapeutic procedures reduce the risk of deterioration of sharpness of vision by over 90%. These procedures include intervention of suggestible risk factors, active DR screening and specialised ophthalmological treatment.

2. EPIDEMIOLOGICAL CHARACTERISTICS

The prevalence of DR is significantly conditioned by the duration of the disorder. According to the statistical data published by the Institute of Health Information and Statistics of the Czech Republic (IHIS), the number of diabetics in the Czech Republic in 2011 was over 825 thousand, which represented an increase in prevalence of more than 19 thousand diabetics in comparison with the previous year. Of this number, 6.7% had type 1 diabetes, 91.9% type 2 DM and 1.4% had other forms of DM. It is envisaged that in future years every tenth citizen in the Czech Republic will suffer from diabetes. The statistics also register 58 412 persons with a glucose tolerance disorder.

The most frequent microvascular complication of DM is **diabetic retinopathy**. In 2011 a total of 99 779 diabetics with DR (12.1%) were registered. Of this number, the proliferative form of DR (PDR) was determined in 25 051 diabetics, which is 3% of the total number of diabetics and 25.1% of the number of diabetics with DR.

The occurrence of **diabetic maculopathy (DMP)**, i.e. a stage of DR which may endanger central sharpness of vision, has never been statistically monitored in the Czech Republic. Fundamental differences in the incidence and prevalence of **diabetic macular edema (DME)** recorded in various epidemiological studies depend on the type of DM, the method of treatment (insulin, PAD or only diet), the duration of DM and the age of the sufferers. DME may develop in various stages of DR, however it occurs more frequently in the case of serious forms of DR. The prevalence of DME increases with the length of duration of DM and is directly dependent upon the level of glycated haemoglobin (HbA1c) and the presence of nephropathy. According to international statistics, DME occurs in 40% of type 1 diabetics after 25 years of duration of DM. It is found in 20% of type 2 diabetics after seven years of duration of DM and in 40% after 20 years.

In 2011 2 280 blind diabetics were registered in the Czech Republic, i.e. 0.3% of the diabetic population.

3. PATHOPHYSIOLOGICAL PRINCIPLE AND MORPHOLOGICAL CHARACTERISTICS

Genetic and metabolic factors are manifested in the pathogenesis and progression of DR, of which the most important role is played by chronic hyperglycaemia with the connected metabolic pathways (glycosylation of proteins, polyol pathway of glucose metabolism, oxidisation stress). The occurrence and deterioration of DR is negatively affected also by hypertension. The data about the influence of serum lipoids and the mechanism of their impact on the development of DR is not convincing.

As a result of haemodynamic, rheological and structural changes in the retinal microcirculation, there is a gradual increase in capillary permeability, an obliteration of the capillaries and an occurrence of areas of capillary non-perfusion, which in type 1 DM are predominantly localised the central periphery of the retina and in type 2 DM in the area of the posterior pole of the eye. Chronic retinal hypoxia is a stimulus for the new formation of vessels in the retina and along the posterior surface of the vitreous body. A significant element influencing DR is changes of the pigment epithelium of the retina and neurodegenerative changes of the nerve and glial cells of the retina.

4. CLASSIFICATION AND CLINICAL CHARACTERISTICS

On the basis of the dynamic of retinal changes, we differentiate between the following clinical stages and forms of DR: **non-proliferative DR** (NPDR), **proliferative DR** (PDR) and **DMP**.

Non-proliferative DR (NPDR). The fundamental clinical symptoms of NPDR are microanurysms, haemorrhages, phlebopathy, intraretinal microvascural abnormalities (IRMA) and cotton wool spots (CWSs). According to the degree of advancement of the changes, it is possible to divide NPDR further into incipient[4 – 0 – 0], the numbers in the brackets indicating the number of quadrants in which clinical progressive symptoms of closure of capillaries are present: haemorr**hage – phlebopathy – intraretinal microvascular abnormalities), intermediate** [4 – 1 – 0] and advanced. Advanced NPDR has a wide range of clinical progressive symptoms of retinal non-perfusion and ischemia, a dynamically changing advanced form [4 – 2 – 1] into a very advanced form of NPDR [4 – 4 – 4].

Proliferative DR (PDR). An essential element for diagnosis is the presence of newly-formed blood vessels anywhere on the retina and/or papilla of the optic nerve with or without the presence of accom-

Table 1: Clinical stages of diabetic retinopathy

Order	Finding on fundus	Minimal frequency of checks
• Non-proliferative DR		
Incipient	microaneurysms microhaemorrhage Intraretinal haemorrhage Venous abnormalities	6-12 months
Intermediate	Vascular lesions in area of macula Hard exudates cotton wool spots (CWSs)	6-12 months
Advanced	Intraretinal microvascular abnormalities (IRMA) Retinal ischemia	3-6 months
• Proliferative DR		
Initial	Retinal neovascularisation (epiretinal) Papillary neovascularisation (epiretinal)	According to ophthalmologist
High-risk	Traction amotio retinae Intravitreous haemorrhage	
• Diabetic maculopathy	Macular edema Clinically significant macular edema	According to ophthalmologist

panying fibre tissue. In addition to a progressive finding of retinal and epiretinal neovascularisation with the presence of fibrous tissue, advanced PDR is also manifested in complications such as preretinal, retrovitreal and intravitreal bleeding, traction and/or rhegmatogenous detachment of the retina and neovascularisation on the iris. According to the dynamic of the disorder, we differentiate between **initial** and **high risk PDR**. **High risk PDR** is defined by the presence of neovascularisation on the papilla of the optic nerve within the scope of ¼ to 1/3 of the papilla and/or new formation of blood vessels anywhere on the retina, affecting at least ¼ of the surface of the papilla, accompanied by bleeding into the vitreous cavity.

DMP occurs as a consequence of a collapse of the haematoocular barrier, and results in an accumulation of extracellular fluid, a retinal edema and usually also an accumulation of proteins and lipids in the form of hard exudates. Usually DME is defined as retinal thickening or the presence of hard exudates within the range of 1 papillary diameter (1500 microns) from the centre of the macula. DME may occur or persist also as a consequence of vitreomacular (VM) traction.

Classification of DME:

a) Focal – characterised primarily by discreet exudation from microaneurysms and capillaries. The areas of focal exudation are frequently bordered by an incomplete or complete ring of hard exudates.

b) Diffuse – characterised by extensive thickening of the macula and distinctive exudation primarily of the dilatated capillaries in the perifoveal area and from the deep capillary network. Diffusive DME is usually symmetrical and without marked exudation.

c) Cystoid – regularly accompanied by diffusive edema and characterised by exudation into the preformed areas of deeper, primarily nerve fiber layers of the retina. The presence or lack of cystoid areas does not directly affect the prognosis and treatment of DME.

d) Ischemic maculopathy – characterised by a decrease or loss of the perifoveol capillary network and an extension of the foveolar avascular zone (FAZ) and seriously damages sharpness of vision.

e) Mixed – in clinical practice mixed forms are widely observed.

Clinically significant macular edemas (CSME). The Early Treatment Diabetic Retinopathy Study (ETDRS) uses this clearly defined expression in order to emphasise a macular edema which immediately threatens the fovea and central sharpness of vision. It is defined as a thickening of the retina to a distance of 500µm from the centre of the macula. Hard exudates to a distance of 500µm from the centre of the macula, if they reach into the area of the saturated retina. Exudation of the retina greater than the surface of the papilla diameter (PD), if part of this exudation lies at a distance to the diameter of 1 PD from the centre of the macula.

5. DIAGNOSIS

Diagnostic methods for identifying DR are biomicroscopic examination of the fundus on a slit lamp, simple photography, photography with a colour filter, stereoscopic photography and fluorescent angiography (FAG). These methods are simple, safe and capable of differentiating between patients with and without DR. All examinations of the fundus are performed after pharmacological dilation of the pupil using 2.5% phenylephrine (sympathomimetic drug) and 1% tropicamide (parasympathomimetic drug).

Biomicroscopic examination on slit lamp is a sufficiently sensitive method for determining diagnosis of DR, newly-formed blood vessels in the iris, for determining the presence of thickening of the retina in the area of the macula and neovascular changes on the papilla or anywhere on the retina. The examination is performed using an aspheric lens of 90 dioptres or other types of noncontact and also contact lenses.

Stereoscopic photography or **digital stereophotography** in 7 fields according to the Airlie House Classification is the "gold standard" for evaluation of the degree of DR (ETDRS and EURODIAB studies). The evaluation is performed in Retinopathy Grading centres. Colour photo documentation of the basic two fields (central and disconasal in 40° field) should always be performed in all risk patients with advanced forms of DR.

Fluorescent angiography is a supplementary method and is not recommended for the practical purposes of screening. It is not necessary for the diagnosis of CSME or PDR. It may be indicated prior to laser coagulation of DMP and CSME, to determine the extent of macular capillary non-perfusion, fine neovascularisations, or to assess an unexplained decrease of sharpness of vision.

Optical coherence tomography (OCT) is a specialised examination of the macula using the principle of high-definition, low-coherence interferometry. It is the most advanced method, which enables a display of retinal structures with a high-definition capability of up to 3µm in the form of a cross-section. A classic linear B-scan, as well as a "C-scan", is available. The C-scan displays a cross-section of the retina in the frontal plane. The examination is non-invasive and can be performed at high speed, without the necessity for pupil dilatation. It can be used to monitor anatomical and functional changes of the macula over time, as well as the effectiveness of treatment of DME

6. THERAPEUTIC PROCEDURES

Treatment and prevention of DR resides in lifestyle and pharmacological treatment of modifiable risk factors, in particular hyperglycaemia and hypertension, and specialised ophthalmological treatment. A condition is active ophthal-

Table 2 Targets for treatment of diabetic patient

Indicator	Required value
HbA1c (%) *	< 4.5 (< 6.0)
Glycaemia in venous plasma on empty stomach/before food (mmol/l)	6.0 (< 7.0)
Glycaemia in full capillary blood (self-monitoring)	
on empty stomach/before food (mmol/l)	4.0-6.0 (< 8.0)
postprandial (mmol/l)	5.0–7.5 (< 9.0)
Blood pressure (mmHg)	< 130/80
Blood lipids	
Total cholesterol (mmol/l)	< 4.5
LDL cholesterol (mmol/l) ***	< 2.5
HDL cholesterol (mmol/l): men/women	> 1 / > 1.2
Triglycerides (mmol/l)	< 1.7
Body mass index **	19-25
Waist circumference: women (cm) / men (cm)	< 80 / < 94

* HbA1c – is determined according to the recommendation of the International Federation of Clinical Chemistry (IFCC)
** in overweight and obese patients, the target is permanent reduction of body weight by 5–10%
*** in diabetic patients after cardiovascular events, LDL cholesterol below 2.0 mmol/l
The figures in brackets are the recommended values for diabetic patients with a high cardiovascular risk. The target values should be determined individually.
Since 1 January 2012 a new unit has been introduced to express the results of measurement of HbA1c, which is expressed in mmol/mol. The referential interval for the healthy adult population is 20 to 42 mmol/mol, for compensated DM 43 to 53 mmol/mol.

mological screening. No specific pharmacological treatment exists at present.

Treatment of risk factors

Conditions for successful treatment are good compliance of the patient and satisfactory compensation of DM and other risk factors. The target values recommended from the perspective of preventing the occurrence and progression of all micro- and macrovascular complications, including DR, in both types of diabetes are listed in Table 2. These target values are within the normal range of the observed parameter and cannot be achieved in a certain number of patients. We set individual treatment targets for each patient.

Treatment of hyperglycaemia

It is clearly substantiated that close compensation of diabetes is effective in preventing the development and progression of DR, in which "metabolic memory" is applied. The greatest demands for close compensation (HbA1c < 4.5%) are irrespective of the type of diabetes during the period immediately following identification of the disorder, and in persons with a low cardiovascular risk (patients with diabetes of a short duration, without a history of cardiovascular events in anamnesis and current values of HbA1c approx. to 7.0%). In persons with associated serious diseases, in whom hypoglycaemia increases the risk of cardiovascular complications, we are less strict (HbA1c less than 6%). A fundamental requirement safety of treatment (absence of hypoglycaemia). The drop in blood sugar levels should not be sharp, particularly in patients with long-term severely decompensated DM (see risk for early normoglycaemic deterioration). Optimum compensation should be attained gradually over the course of several months.

Any decrease in HbA1c, even if it does not attain the target value, is beneficial from the perspective of stabilisation of DR. A review of the treatment of hyperglycaemia is usually conducted when HbA1c exceeds 5,3%.

In the endeavour to reduce hyperglycaemia, the choice of hypoglycaemic agent is not of decisive significance, the important factor is the attained value of compensation of diabetes (UKPDS, DCCT).

Treatment of hypertension

Normalisation and stabilisation of blood pressure have also been clearly shown to be effective in the treatment of DR. However, a question still remains as to whether the individual groups of antihypertensive drugs may also have a specific impact on the course of DR. The drugs of choice in the treatment of hypertension in diabetic patients are ACE inhibitors and sartans. However, evidence supporting their advantageousness is based on their cardioprotective and nephroprotective effects, and from the perspective of the progression of retinopathy, the choice of medicaments is not of decisive importance according to the existing state of evidence.

Treatment of dyslipidemia

Epidemiological studies demonstrate significant relationships between the occurrence of hard deposits on the retina and LDL cholesterol levels in serum, as well as between LDL and the severity of DR and an association between DR and intima-media thickness measured on the carotid artery. Similarly, triglyceride levels in serum are associated with the severity of retinopathy severity, and in prospective studies have emerged as an independent risk factor for DR. Interventional studies which have shown that hypolipidemic treatment genuinely reduces the risk of DR progression are not yet available. Interesting results currently being verified have been produced by sub-analyses of the large mortality studies FIELD and ACCORD. FIELD demonstrated a highly significant reduction in the numbers of laser photocoagulation procedures in a group of patients with Type 2 DM treated with fenofibrate (by 30%) in comparison with a placebo. Similar positive results were produced by the addition of a fibrate to a combination with a statin in comparison with statin monotherapy (ACCORD).

Specialised ophthalmological treatment

Four fundamental options are currently available in the treatment of DR:

1. Focal or grid macular photocoagulation of the macula
2. Panretinal photocoagulation
3. Pars plana vitrectomy
4. Intravitreal treatment

Laser coagulation of the retina – this significantly reduces the risk of loss of sharpness of vision. Timely treatment of indicated stages of DR and DME is a decisive factor in the prevention of loss of sharpness of vision. The effectiveness of laser coagulation is preventive and as a rule is unable to reverse any loss of sharpness of vision. It is difficult to stipulate unequivocal standards for laser treatment of DR and DME, and the presented guidelines are thus general recommendations based on the DRS (Diabetic Retinopathy Study) and ETDRS. Laser coagulation may be fo-

cal, quadrant or panretinal. Choice of the type of procedure depends not only on the severity of DR but also on the presence of other risk factors.

Incipient NPDR – this stage does not require laser therapy.

Intermediate NPDR – in this stage laser coagulation of the retina is not usually performed.

Intermediate NPDR with presence of CSME – in long-term subcompensated and decompensated diabetic patients we recommend FAG. In the presence of focal or diffuse exudation in the macula or in the region of non-perfusion, it is suitable to start with focal laser coagulation of the macula in order to stabilise sharpness of vision.

Advanced NPDR – this usually requires quadrant/panretinal coagulation of the retina.

Advanced NPDR accompanied by CSME in type 1 diabetics – photocoagulation of the central periphery of the retina or quadrant photocoagulation of the retina is performed, and if CSME does not regress there follows focal, grid, or modified grid macular photocoagulation.

Advanced NPDR accompanied by CSME in patients with type 2 diabetes and MODY – laser treatment may be considered, and we recommend beginning first of all with laser photocoagulation of the macula. The benefit of early panretinal photocoagulation in type 2 diabetics is greater than in patients with type 1 DM.

DME – this is a common indication for photocoagulation. It is necessary to start treatment sufficiently in time. The patient must be informed of the necessity of commencing treatment before sharpness of vision deteriorates. Statistically, sharpness of vision has been shown to improve following edema resorption in only 15% of patients (see combination therapy below).

CSME – This is always treated by laser photocoagulation. Selection of the method of laser therapy then depends upon the clinical manifestations of the edema. This condition requires focal / grid laser coagulation alone and/or in combination with other variants of treatment, such as anti-VEGF preparations or steroids applied intravitreally.

PDR – This is always an indication for laser therapy. The method of therapy is based on the type and extent of proliferation.

Retinal neovascularisation (RNV). In patients with the insulin dependent diabetes mellitus type 2 there is quite good response to focal or quadrant coagulation. In type 1 diabetics, panretinal photocoagulation is more appropriate.

Papillary neovascularisation (PNV) of the optic nerve is almost always an indication for panretinal photocoagulation.

Persistent newly formed vessels may present a major problem. Targeted coagulation is associated with a relatively high risk of haemophthalmus. Regression of these neovascularisations can be influenced by intraocular application of an anti-VEGF preparation.

Normoglycaemic re-entry phenomenon In patients with an anticipated rapid drop in glycated haemoglobin from levels of over 11%, we recommend panretinal photocoagulation in the case of advanced form of NPDR and PDR.

A serious side effect of panretinal photocoagulation is the occurrence or worsening of DME. As a result, we generally perform panretinal photocoagulation in 4 or 5 separate sessions, with an interval of several days.

Combined treatment of DME

The RESTORE, READ-2a Diabetic Retinopathy Clinical Research Network Studies (DRCRnet) studies confirm the significance of combination therapy by laser coagulation and intravitreal administration of anti-VEGF preparations and steroids.

In the RESTORE study, the effectiveness and safety of ranibizumab (Lucentis, Genentech Inc., Novartis Pharma AG) was determined in patients with deterioration of visual functions due to DME. The study demonstrated an improvement both after intravitreal injection of ranibizumab in monotherapy and in combination with laser coagulation of the macular edema of the retina, which was performed prior to the intravitreal procedure.

Within the framework of a DRCRnet pilot study, traimcinolone acetonide was compared to standard treatment by laser photocoagulation of the retina. The study demonstrated an improved effect of treatment of macular edema by laser in comparison with intravitreal application of traimcinolone.

A range of studies have demonstrated the effectiveness and safety of bevacizumab (Avastin, Genentech Inc., Roche Ltd.) in the treatment of DME, though use thereof remains only within the off-label regime.

Pars plana vitrectomy (PPV).

This is a microsurgical procedure in the vitreous area and on the retina, with the option of endolaser photocoagulation. The principle of the operation is the removal of vitreous opacification and the removal of vitreoretinal adhesions, preparation and removal of epiretinal and subretinal membranes with subsequent re-attachment of the retina in the case of its detachment, followed by laser coagulation of the retina. In studies it has been demonstrated that vitrectomy with or without the removal of the internal limiting membrane (ILM) of the retina is an effective and beneficial treatment in eyes with diffuse and/or cystoids DME, which do not respond to laser coagulation. In the prospective study it was further confirmed that thickness of the ILM depends not only on the age, duration of DM and sex of patients, but also on long-term compensation of DM.

Basic indications of pars plana vitrectomy of DR and its complications can be divided into several groups:

- non-resorbing vitreous haemorrhage
- traction detachment of the retina threatening the macula
- combined traction and rhegmatogenous detachment of the retina
- advanced progressive fibrovascular proliferation
- florid PDR not responding to laser photocoagulation
- neovascularisation of the iris associated with vitreous haemorrhage
- dense, non-resorbing premacular haemorrhage
- macular edema not responding to laser coagulation

The procedure is performed in specialised workplaces and vitreoretinal centres. The final decision on indication of vitrectomy is within the jurisdiction of a vitreoretinal surgeon, in particular with regard to the realistic possibilities for improvement of the visual functions of the patient. In the decision-making process it is necessary to consider a whole range of factors, such as the visual functions of the other eye; a finding of severe ischemic changes on the retina of the other eye signals that a similar finding can be expected on the eye to be operated on for opacified vitreous body, and here even despite a successfully performed operation, there is frequently no improvement in the patient's vision. In indicated cases of PDR, it is advantageous to use preoperative intraocular injection of an anti-VEGF, which reduces the risk of peroperative and postoperative bleeding and increases the chance for a better postoperative result.

Other pharmacological treatment

Causal pharmacological treatment of clinically developed DR is not known. To date, no drug has been confirmed to be effective in acting specifically on the occurrence and

progression of DR. At present, the administration of substances such as vasodilators, antiaggregant drugs, vitamins, dobesilate calcium and others with regard to the prevention or treatment of DR is not justified.

Antiaggregation and anticoagulation treatment in case of DR

It has been demonstrated that the administration of acetylsalicylic acid in a standard dose (75–150 mg/day) does not increase the risk of intravitreous haemorrhage in DR. As a result, DR does not represent a contraindication for the administration of acetylsalicylic acid within the framework of secondary prevention of ischemic heart disease. There is a discussion concerning the risk of anticoagulation treatment or fibrinolytic treatment in the case of myocardial infarction, pulmonary embolism and other vital indications. In these vital cases, DR should not represent a contraindication for use of the above-stated preparations. It is evident that in non-vital indications such as heparinisation in haemodialysis or venous thrombosis, extreme caution should be exercised, whilst carefully monitoring the haemocoagulation parameters, particularly in high-risk forms of PDR. Unless it concerns a vital indication, anticoagulation treatment is not administered in the early period following a recent intraocular haemorrhage.

Normoglycaemic re-entry phenomenon

This concerns a transitional worsening of DR, which may occur after a rapid improvement in diabetes compensation in patients with types 1 and 2 diabetes, for example after commencement of treatment with insulin, introduction of an intensified insulin regime, transition to treatment with an insulin pump or a pancreas transplant. The increase in levels of growth factors causes a rapid progression of advanced forms of diabetic retinopathy and maculopathy on the fundus. This condition is characterized by severe hypoxia, edema and the occurrence of soft exudates. Risk factors include a high HbA1c level and severity of DR. Although this is not a fatal complication, its clinical course may not be always benign.

Recommended procedure upon anticipated rapid decrease in glycaemia:

- **Intermediate NPDR** – examination by an ophthalmologist every 2-3 months
- **Advanced NPDR a developing PDR** – panretinal photocoagulation
- **DME** – perform FAG, if applicable with subsequent laser photocoagulation

If possible, an endeavour should be made to ensure slower compensation for severely decompensated patients (over a period of several months)! The risk of normoglycaemic re-entry phenomenon must never be the cause of deferring intensified therapy!

Pregnancy and childbirth

In the case that a patient with DR decides to conceive, it is necessary to notify the patient of the risk of acceleration of the ocular finding. Examinations are necessary before conception and subsequently in each trimester. Stabilisation of DR using the available measures is essential. Pregnancy is not a contraindication for laser therapy. NPDR is not a contraindication for spontaneous delivery. PDR is not an indication for Caesarian section, though patient-friendly guidance of childbirth is recommended.

7. PROGNOSIS AND PREVENTION

Prevention of the occurrence and progression of DR may be implemented on the precondition of professional co-operation of diabetologists, specialists of internal medicine, general practitioners and ophthalmologists. The aim of treatment of DM patients by a diabetologist in relation to the prevention and stabilisation of DR is long-term satisfactory compensation of DM and control of hypertension. For diabetic patients the diabetologist will recommend an examination by an ophthalmologist at the time of determination of the diagnosis of both types of DM (symptoms of DR may already be present), and subsequently a minimum of 1x per year. The ophthalmologist is then responsible for identification of DR, keeps a record of diabetic patients with DR, invites them for regular examinations and ensures specialised ophthalmological treatment. Active screening is performed by the ophthalmologist on children aged over 10 years, in the case of types 1 and 2 DM immediately after DM has been diagnosed. Check-ups for diabetic patients with DR are more frequent (every 3 to 6 months), depending primarily on the degree of DR. More frequent check-ups are also necessary during pregnancy and in the case of an anticipated improvement of diabetes compensation (e.g. after introduction of intensified insulin therapy, insulin pump therapy, or after a pancreas transplant), as well as at the time of commencement of dialysis. In these cases it is appropriate for the diabetologist to be in contact with the ophthalmologist.

8. ASSESSMENT PERSPECTIVES IN OCULAR COMPLICATIONS OF DR

Advanced stages of DR which significantly reduce sharpness of vision or limit the visual field are indications for recognition of partial or full disability, taking into consideration the specific circumstances in the individual patients according to the relevant regulations.

Blindness is understood to mean a visual disorder in which visual functions (distance vision, visual field) are severely reduced or non-exist. The categorisation of blindness has been performed according to the recommendations of the World Health Organization. Patients with visual disorders have been divided, according to sharpness of vision with the best possible correction in the better eye, into slightly visually-impaired (vision maximally less than 6/18 or minimally equal to or better than 6/60), severely visually-impaired (vision maximally less than 6/60 or minimally equal to or better than 3/60), practically blind (vision below 3/60 or visual field less than 10°), blind (vision below 1/60 or visual field less than 5°) and total blind (uncorrect light perception or loss thereof). The term “patient with residual vision” indicates a patient who has vision within the scope of severe visual impairment to practical blindness.

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