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Diabetic Retinopathy Department

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KEYWORDS
diabetic retinopathy; Hyperglycemia; Blindness Prevention.

ABSTRACT
Diabetic retinopathy (RD) is a chronic microvascular complication of diabetes mellitus and a leading cause of preventable blindness globally. It results from prolonged hyperglycemia causing oxidative stress, inflammation, and retinal endothelial dysfunction. These changes lead to capillary leakage, microvascular occlusion, and pathological neovascularization. The prevalence of RD rises with the growing diabetic population worldwide. Major risk factors include poor glycemic control, hypertension, dyslipidemia, and diabetes duration. Early detection via wide pupil funduscopy and treatments like laser photocoagulation and anti-VEGF injections effectively slow disease progression. RD manifests in stages from mild to severe nonproliferative retinopathy, progressing to proliferative diabetic retinopathy with abnormal new vessel growth risking vision loss. Control of systemic factors such as glucose and blood pressure is essential alongside regular retinal screenings. This complex disease requires a multidisciplinary approach for diagnosis and treatment to prevent permanent blindness. This study contributes valuable national insight into diabetic eye complications and underscores the importance of routine screening, patient education, and innovative therapies to improve vision and reduce blindness rates associated with RD. The medical management focus includes maintaining HbA1c within recommended levels (48-58 mmol/mol), controlling blood pressure under 140/80 mmHg, and lifestyle changes. Early identification and treatment are critical for preserving vision quality in diabetic patients at risk of RD.

INTRODUCTION

According to the American Diabetes Association, diabetes mellitus is a group of metabolic disorders characterized by an increase in blood glucose levels due to abnormal insulin secretion or function, or both (Baynest, 2015). Chronic hyperglycemia in diabetes over the long term can lead to damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels (Alanazi et al., 2024; Roy, 2025; Sari, Wibisono, & Renityas, 2022). One of the most common microvascular complications found in people with diabetes is diabetic retinopathy (DR), now recognized as the leading cause of preventable blindness in the productive age population worldwide (American Diabetes Association, 2024).

World Health Organization (WHO, 2019) data show that around 463 million people worldwide had diabetes in 2019, with this number expected to increase to 700 million by 2045.

Among these diabetics, more than one-third have some form of diabetic retinopathy, and about 10% of them have vision-threatening diabetic retinopathy (Hou et al., 2023; Sapkota, Chen, Zheng, & Pardhan, 2019; Singh, Das, Deka, & Kalita, 2021). In Indonesia, the prevalence of diabetes continues to rise with lifestyle changes, and an estimated 12.4 million people experienced the disease in 2021, with most undiagnosed early (Ministry of Health of the Republic of Indonesia, Riskesdas, 2021).

Diabetic retinopathy is one of the chronic microvascular complications caused by damage to retinal blood vessels due to prolonged hyperglycemia in people with diabetes mellitus (Ansari et al., 2022; Khalil, 2017). High blood glucose levels over the long term provoke oxidative stress, inflammation, and thickening of the basal capillary membrane of the retina. These changes lead to capillary leakage, microvascular occlusion, and retinal ischemia, which ultimately trigger the formation of pathological neovascularization (Fu & Chakrabarti, 2022). This condition develops gradually, ranging from non-proliferative diabetic retinopathy (NPDR) to proliferative diabetic retinopathy (PDR) (Sardarinia et al., 2022; Sivaprasad & Pearce, 2018). Along with disease progression, diabetic macular edema (DME) can also arise, playing a major role in sharp vision decrease (Judy E, 2025).

A thorough eye examination with dilated fundus examination is recommended periodically in all diabetic patients, especially those exhibiting signs of diabetic retinopathy (Furundaoturan, Afrashi, Akkın, Menteş, & Nalçacı, 2025; Rahat et al., 2025). This examination aims to detect early retinal changes so that vision loss can be prevented or slowed. This effort must be accompanied by optimal management of blood glucose levels and blood pressure, as these two factors have been shown to be crucial in slowing disease progression (American Diabetes Association, 2024).

The objectives of this study are to: (1) analyze the pathophysiological mechanisms of diabetic retinopathy as a microvascular complication of diabetes mellitus; (2) identify risk factors that affect disease progression; (3) evaluate the latest diagnosis and management strategies for diabetic retinopathy; and (4) formulate comprehensive prevention and management recommendations to reduce the risk of blindness. The research benefits include theoretical contributions to enriching the understanding of the pathophysiological mechanisms of diabetic retinopathy and the application of evidence-based medicine in clinical management. Practically, this study is expected to serve as a guideline for health workers in early detection and proper management, as well as to increase public awareness about the importance of glycemic control and routine eye exams in diabetics.

RESEARCH METHOD

This research was prepared using a literature study method with a qualitative descriptive approach. Data collection was carried out by examining secondary sources from trusted scientific publications, including international and national journals, medical textbooks, and clinical guidelines from health organizations such as the World Health Organization (WHO), the American Diabetes Association (ADA), and the Ministry of Health of the Republic of Indonesia. Literature

searches were conducted systematically through electronic databases such as PubMed, Google Scholar, and ScienceDirect with the main keywords "diabetic retinopathy", "pathophysiology", "management", and "prevention", with priority given to literature published in the last 10 years. The collected data were then qualitatively analyzed through narrative synthesis, where findings from various sources were identified, grouped by theme, and systematically compiled to provide a comprehensive overview of the pathophysiology, diagnosis, management, and prevention strategies of Diabetic Retinopathy. This method was chosen to provide a deep and integrated understanding of the complexity of the disease.

Result and Discussion

This reference is compiled to comprehensively explain Diabetic Retinopathy as one of the chronic microvascular complications due to diabetes mellitus which plays a major role in the decline of vision function. The discussion will cover various main aspects including the definition, classification, and mechanism of pathological changes in the retina caused by prolonged hyperglycemia. In addition, theories related to risk factors that affect the onset of this disease will be described. Epidemiological aspects will be presented in a structured manner to provide an overview of the incidence, prevalence, and distribution of Diabetic Retinopathy at the global and national levels, as well as the most vulnerable population groups. The pathophysiology section will explain the course of the disease starting from endothelial damage of retinal blood vessels to the formation of neovascularization that marks the advanced phase of the disease. Clinical manifestations will be systematically described based on the stage of the disease, ranging from non-proliferative to proliferative forms, along with complications that may arise such as vitreous hemorrhage and retinal detachment. The diagnosis section will discuss the examination procedures necessary to establish the diagnosis appropriately, including an anamnesis, funduscopy examination, and other relevant supporting examinations. Furthermore, the management will be thoroughly described including medical therapy, photocoagulation laser, anti-VEGF administration, and surgical handling in advanced cases. The discussion also included prevention strategies, long-term monitoring, and factors that affect the visual prognosis and quality of life of patients with Diabetic Retinopathy.

The preparation of this reference is expected to provide meaningful educational benefits for health workers in improving a comprehensive understanding of the complexity of Diabetic Retinopathy (RD) as one of the chronic complications of diabetes mellitus that has a serious impact on vision function. For medical students and young doctors, this reference serves as a comprehensive learning resource that integrates the basic concepts of pathophysiology with clinical application in the diagnosis process and management of patients with RD. From a practical perspective, this referral can expand clinicians' ability to carry out early detection and appropriate management to prevent irreversible complications that have the potential to cause blindness. Evidence-based medicine discussions are expected to support the improvement of the quality of health services, so as to be able to improve patient outcomes and the efficiency of the overall service system. In the context of public health, a better understanding of Diabetic Retinopathy can

help in the development of routine screening programs as well as more effective prevention strategies in high-risk groups, especially patients with poor glycemic control or long duration of diabetes. This reference is also expected to contribute to enriching the academic literature on diabetic ocular complications in Indonesia, as well as becoming a reference in public education regarding the importance of periodic eye exams for diabetics. The research benefits of the preparation of this reference include the identification of knowledge gaps and opportunities for further research on pathogenic mechanisms and RD therapeutic innovations. The information presented is expected to be the basis for the development of more effective and cost-efficient interventions in the treatment of this disease. For patients and families, a proper understanding of the course of the disease and the importance of adherence to therapy can improve quality of life, slow the progression of the disease, and reduce the risk of permanent blindness. From an economic perspective, the implementation of early diagnosis and proper management also has the potential to reduce the long-term cost burden due to severe complications from Diabetic Retinopathy that are not optimally treated.

Anatomy Feed

The eye is an organ of vision that functions to capture and transmit light stimuli so that they can be translated into visual perception by the brain. Anatomically, the eyeball is almost spherical with a diameter of about 24 mm, and is composed of three main layers, namely the fibrous, vascular, and retinal layers. The fibrous layer consists of a transparent cornea on the front and a sclera on the back that is white and strong, which functions to protect the structures inside the eyeball. The vascular layer or uvea includes the iris, ciliary body, and choroid, which play a role in regulating incoming light as well as providing nutrients to the retina (Guyton & Hall, 2021).

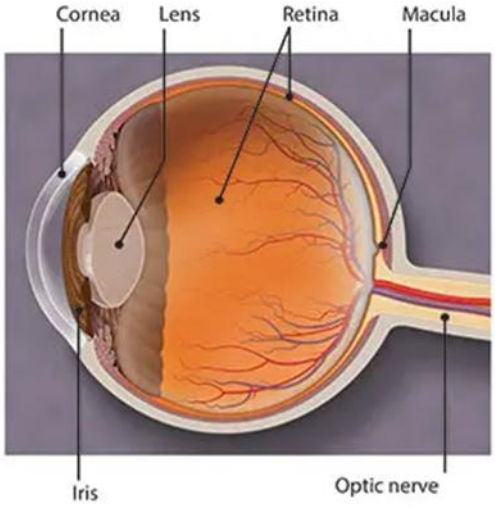
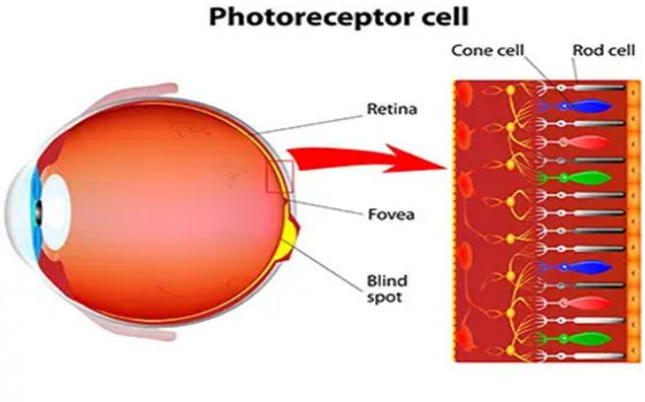


Figure 1. Anatomy of the Eye (Tubert D, 2023)

The deepest layer is the retina, which is a thin neural network that lines the inside of the eyeball and functions to convert light energy into electrical impulses through photoreceptors in the form of rod cells and cone cells. The retina is made up of several cellular layers, including the

ganglion cell layer, inner nuclear layer, and outer nuclear layer, which are interconnected through synapses. In the central part of the retina is the macula lutea, the area with the highest density of cone cells that plays an important role in central vision acuity. The retina gets its blood supply from the central retinal arteries and veins, while its outer layer gets nutrients from the choroid blood vessels. Disorders of the retinal vascular system, such as in diabetes mellitus, can cause pathological changes that are the basis for the formation of diabetic retinopathy (Mahabadi & Tarabishy, 2023).



Gambar 2. Photoreceptor cell (Tubert D, 2023)

Retinopatic diabetics

Definition

Diabetes mellitus (DM) is a chronic metabolic disease characterized by increased blood glucose levels (hyperglycemia) due to impaired insulin secretion, resistance to insulin action, or a combination of the two (PERKENI, 2021). Diabetic retinopathy is a form of microvascular disease of the retina that arises from chronic hyperglycemia. (Sitorus, et al, 2020) Prolonged high blood glucose levels can cause disruption of the flow and distribution of nutrients to retinal tissue, causing damage to the structure and function of the retina. (Purnama, et al, 2023)

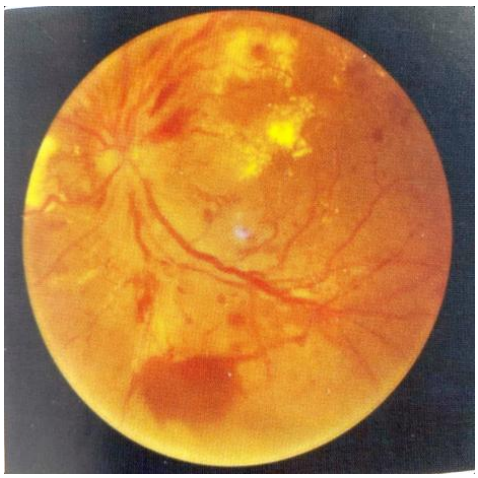


Figure 2.3 Funduscopy in Diabetic Retinopathy (Ilyas S, 2022)

It can be seen that the dilation of the retinal veins with an arterial:venous ratio of 1:2 and an increase in venous tortuosity can be seen. In the retinal layer, hard exudate was found, dot-shaped and flame-shaped hemorrhages, and microaneurysms.

Epidemiology

Retinopathy is the leading cause of vision disorders and blindness worldwide. And the main cause of blindness at the age of 20-64 years (Sitorus, et al, 2020), DM sufferers over 20 years old can be at risk of suffering from retinopathy, type I DM 90% and type II DM >60%. And globally, the prevalence of diabetic retinopathy is 34.6%. (Ministry of Health of the Republic of Indonesia, 2023)

World Health Organization (WHO) data shows that about 463 million people in the world had diabetes in 2019, and this number is expected to increase to 700 million by 2045. In Indonesia, the prevalence of diabetes continues to increase with lifestyle changes, and an estimated 12.4 million people experienced the disease in 2021, with most of them undiagnosed early. (Ministry of Health of the Republic of Indonesia, 2023)

Etiology and Risk Factors

Type one diabetes mellitus occurs because the immune system attacks and damages beta cells in the pancreas that function to produce insulin. Meanwhile, type two diabetes mellitus arises as a result of a combination of hereditary factors and an unhealthy lifestyle, such as lack of exercise and a high-calorie diet. Both types of diabetes can cause diabetic retinopathy because high blood sugar levels over a long period of time damage small blood vessels in the retina. This damage disrupts blood flow to the retina and causes changes in the tissues of the eye. In type two diabetes mellitus, some genes such as TCF7L2, NOTCH2, KCNQ1, JAZF1, and MODY are known to increase the risk of the disease. Meanwhile, in type one diabetes mellitus, most patients have antibodies that attack the beta cells of the pancreas, so insulin production decreases and blood sugar levels become consistently high. This condition is ultimately the main cause of diabetic retinopathy. (Judy E, 2025)

Risk factors for diabetic retinopathy are divided into two major groups, namely modifiable and non-modifiable risk factors. (Ministry of Health of the Republic of Indonesia, 2023)

Modifiable risk factors

a. Up to HbA1c

Keeping HbA1c levels below 7% has been shown to reduce the risk of diabetic retinopathy and slow the progression of the disease. Based on the results of The Diabetes Control and Complications Trial (DCCT) study, any decrease in HbA1c levels by 1% can reduce the risk of developing diabetic retinopathy by up to 40%, reduce the risk of disease progression to a life-threatening stage by 25%, and reduce the risk of blindness by 15%.

b. Systolic blood pressure

Blood pressure control has an important role in preventing the progression of diabetic retinopathy. A decrease in systolic blood pressure by 10 mmHg has been shown to reduce the risk of diabetic retinopathy by up to 35%.

c. Dyslipidemia

High levels of blood lipids, especially triglycerides and LDL cholesterol, increase the risk of developing diabetic retinopathy. In addition, increased levels of non-HDL cholesterol and an imbalanced HDL/LDL ratio are also associated with an increased risk of diabetic macular edema.

d. Body Mass Index (BMI/BMI)

Being overweight or obese is an additional risk factor. The risk of diabetic retinopathy increases in individuals with a BMI of > 31 kg/m² in males and > 32 kg/m² in females.

1. Non-modifiable risk factors

a. Pubertas

Puberty is a period of increased risk of diabetic retinopathy due to hormonal and metabolic changes. After puberty, the risk of developing diabetic retinopathy increases by about 30%.

b. Pregnancy

Pregnancy can accelerate the progression of diabetic retinopathy by two to three times, especially in patients with poor glycemic control. However, during the postpartum period, about 29% of patients showed repair or regression of retinal lesions after blood glucose levels were controlled.

Classification

Retinopati Diabetic Non-Proliferatif (RDNP)

Microvascular changes that are still limited and have not penetrated the Internal Limiting Membrane (ILM) layer. In nonproliferative diabetic retinopathy, there are mild, moderate, and severe degrees. In this phase, the abnormalities found include (Ministry of Health of the Republic of Indonesia, 2023):

- Microaneurysm (small dilation of the capillary wall of the retina)
- Capillary non-perfusion area (part of the retina that does not get blood flow)
- Infark pada nerve fiber layer (NFL)
- Dot-blot bleeding in the intraretinal layer
- Edema retina
- Hard exudate due to plasma leakage
- Abnormalitas arteriol
- Dilation and beading of the retinal veins

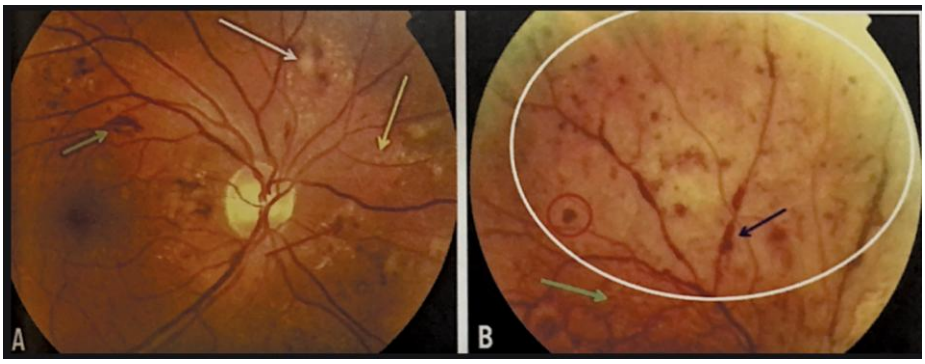


Figure 2.4 Non-Proliferative Diabetic Retinopathy (Sitorus, 2020)

Description: yellow arrow: hard exudate, red arrow: microaneurysm, white arrow: cotton wool spot, green arrow: bleeding, blue arrow: venous beading and segmentation of red circles: dot blot, circle put: retina that looks empty

1. **Mild - moderate – Severe Non-Proliferative (NPDR)**

   In mild degrees, one or more microaneurysms are found. Meanwhile, in moderate degrees, images such as microaneurysms, dot blott bleeding, hard exudate, cotton wool spots (CWS), venous beading, narrowing of the lumen of the arteries and intraretinal Microvascular Abnormalities (IRMA). (Ministry of Health of the Republic of Indonesia, 2023)

2. **Severe Non-Proliferative Severe (NPDR)**

   At this stage, the microvascular changes become more extensive with a high risk of progression to a proliferative stage. Diagnosed when one of the following three criteria is found ("rule 4-2-1") (Ministry of Health of the Republic of Indonesia, 2023):

   - Dot-blot hemorrhage in the four quadrants of the retina
   - Venous beading in two quadrants
   - Intraretinal Microvascular Abnormalities (IRMA) in at least one quadrant of the retina (Ministry of Health of the Republic of Indonesia, 2023)

3. **Very Severe Stage – Non-Severe NPDR**

   This stage is characterized by the presence of two of the three criteria in the previous stage. This condition has a 45% chance of developing Proactive Diabetic Retinopathy (RDP) within one year if not managed properly. (Ministry of Health of the Republic of Indonesia, 2023)

Proliferative Diabetic Retinopathy (RDP)

The advanced stage is characterized by the formation of neovascularization (new blood vessels) in response to chronic retinal ischemia due to diabetes. The location of new blood vessel growth can occur in (Ministry of Health of the Republic of Indonesia, 2023):

- Neovascularization of the Disc (NVD) – di sekitar papil saraf optik
- Neovascularization Elsewhere (NVE) – di area retina lainnya

The proliferation of this fibrovascular tissue develops through three phases:

1. Early growth of new blood vessels along with fibrous tissue that penetrates the Internal Limiting Membrane (ILM)
2. Enlargement and elongation of neovascularization accompanied by an increase in fibrotic components
3. Regression of new vessels and formation of residual fibrovascular tissue along the posterior hyaloid

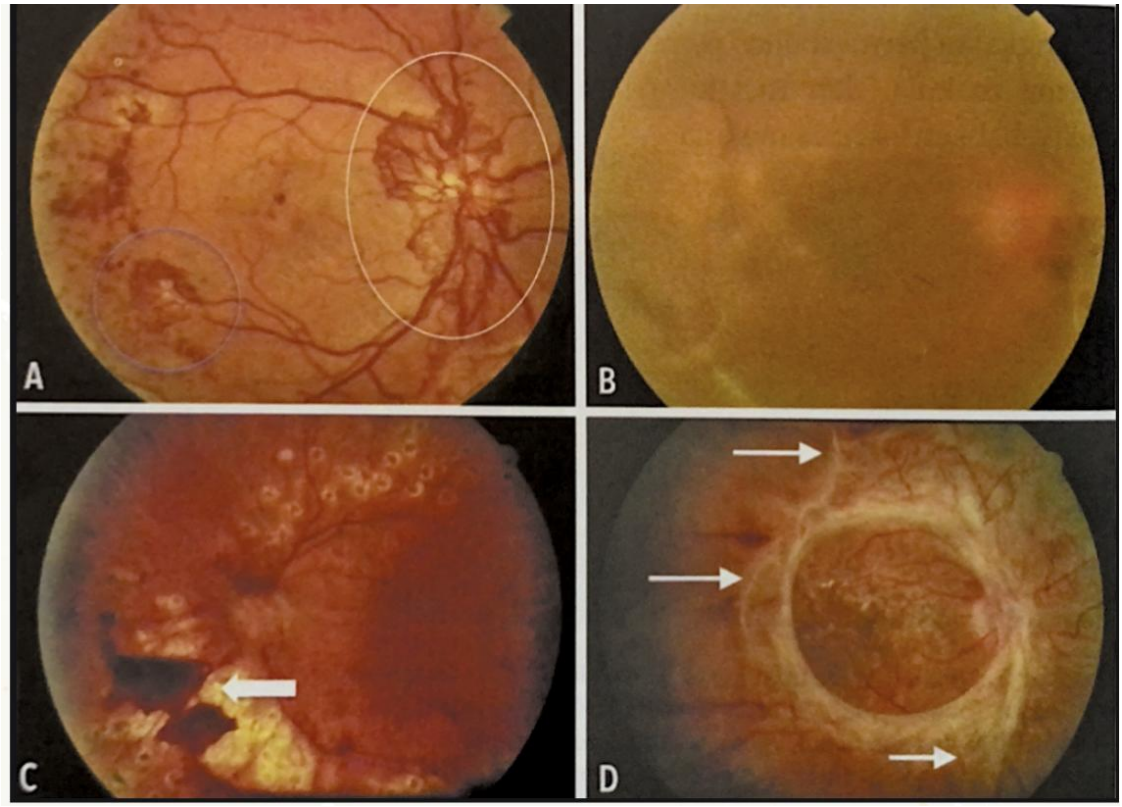


Figure 5. Proliferative Diabetic Retinopathy (Sitorus, 2020)

Description: A. white circles: NVD, blue circles: NVE B. vitreous cloudiness, C. preretinal bleeding, D. heavy fibrosis

Diabetic Macular Edema (EMD)

Diabetic macular edema is an important complication that is the main cause of a sharp decrease in vision in diabetics. This condition is characterized by thickening of the retina that involves or threatens the macular area, with or without hard exudate. Based on the fundus photo, macular edema is classified as CSME (Clinically Significant Macular Edema) if found (Ministry of Health of the Republic of Indonesia, 2023):

- Thickening of the retina that hits the middle of the macula
- Hard exudate within 500 μm of the macular center with thickening of the surrounding retina
- The area of retinal thickening is more than 1 disc area that is within 1 disc diameter of the macular center

International Classification of Diabetic Macular Edema (EMD)

Category	Findings on Dilated Ophthalmoscopy
No EMD	There is no thickening of the retina or hard exudate in the macula.
Noncentral-involved EMD	Thickening of the retina in the macula that does not cover the central subfield zone with a diameter of 1 mm.
Central-involved EMD	Thickening of the retina in the macula that includes the central subfield zone with a diameter of 1 mm.

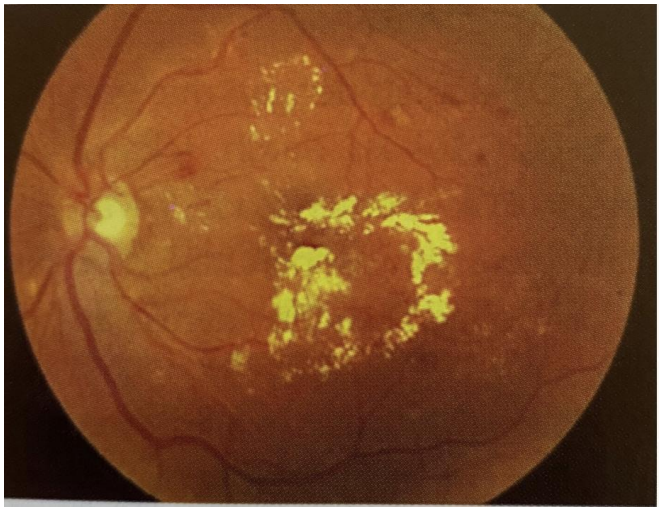


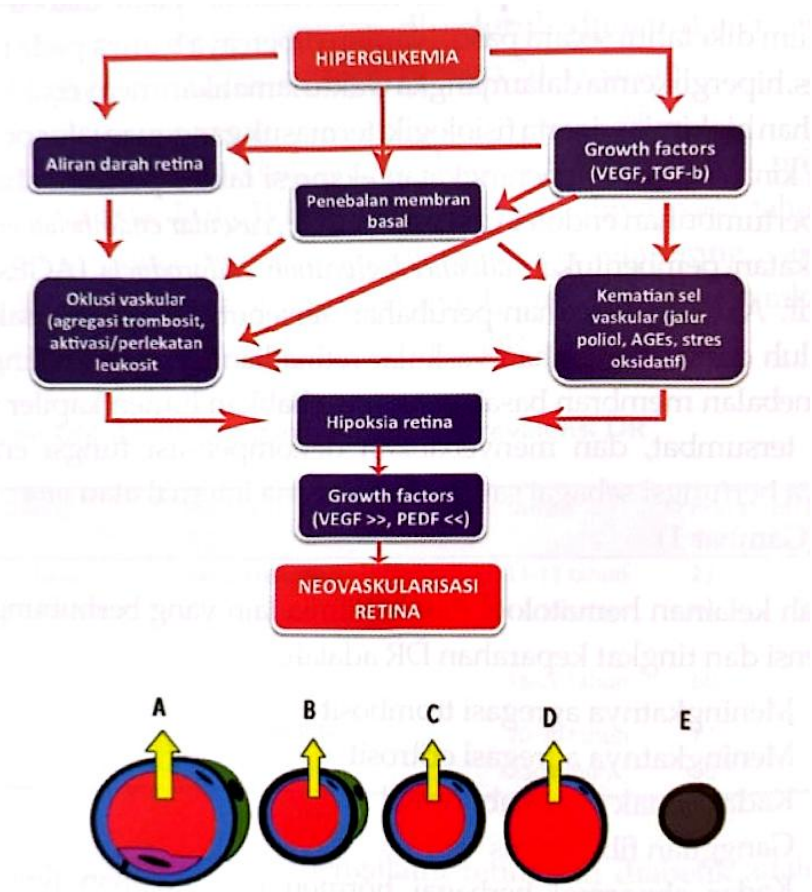
Figure 6. Focal macular edema with ring-shaped hard exudate around the macula
(Sitorus, 2020)

Pathophysiologists

Diabetic retinopathy is a chronic microvascular complication due to prolonged hyperglycemia exposure in people with diabetes mellitus. Chronic hyperglycemia triggers the activation of various pathological metabolic pathways—including polyol pathways, the formation of advanced glycation end-products (AGEs), activation of protein kinase C (CCP), and hexosamine pathways—which contribute to endothelial dysfunction and increased retinal vascular permeability (Frontiers in Cell and Developmental Biology, 2022). Among the typical microvascular changes are pericyte dropout, thickening of the capillary basal membrane, and damage to the neuro-vascular unit of the retina, which in turn disrupts blood flow as well as causes capillary leakage and occlusion (BMC Ophthalmology, 2023; eBioMedicine, 2021). Local ischemia in the retina then promotes increased expression of vascular factors such as vascular endothelial growth factor (VEGF), which triggers pathological neovascularization —

characteristic of the proliferative phase of the disease. Meanwhile, risk factors such as long duration of diabetes, poor glycemic control, hypertension, and dyslipidemia, contribute to accelerating the progression of retinal microvascular damage (MDPI Cells, 2023). Thus, the pathophysiology of diabetic retinopathy is the result of a complex interaction between metabolic dysfunction, oxidative stress, chronic inflammation, and progressive and multifactorial retinal microcirculation disorders.

Figure 2.7 Pathophysiology (Sitorus, 2020)



Clinical Menifaction

Clinical manifestations of diabetic retinopathy include an increased number of floaters in the form of shadows such as spots or lines in vision, blurred vision, as well as vision changes that can fluctuate periodically from blurred to clear. In addition, sufferers can experience dark areas or blank spots in the field of vision, decreased ability to see at night, disturbances in color vision, and progressive decline to sharp loss of vision. (Purnama et al, 2023)

Symptoms of diabetic retinopathy appear as a result of retinal microvascular changes that cause fluid leakage, intra-retinal hemorrhage, and abnormal neovascular tissue formation. In advanced stages, neovascularization can cause vitreous hemorrhage, diabetic macular edema, and tractional retinal detachment that leads to permanent vision loss. This process is triggered by

chronic hyperglycemia that causes oxidative stress, inflammation, as well as increased levels of vascular endothelial growth factor (VEGF) that worsen the permeability and fragility of retinal blood vessels (Fu & Chakrabarti, 2022).

Diagnosis

A. Anamnesis
   1. Opaque
   2. Duration of DM
   3. Blood sugar control
   4. Treatment that has been done.
   5. Other medical conditions
   6. Eye diseases that have been suffered (trauma, ocular injections, surgery, including laser therapy and refractive surgery)

   Clinical symptoms:
   1. Asymptomatic (asymptomatic); If the abnormality in diabetic retinopathy has not caused disturbances in the macula or visual media.
   2. *Floaters.*
   3. Sudden obstruction of vision (in vitreous hemorrhage).
   4. Flashes.
   5. Shadow curtain (when the retina is detached).
   6. Pain in/around the eye (due to increased eyeball pressure in neovascular glaucoma). (Ministry of Health of the Republic of Indonesia, 2023)

B. Examination
   - **Sharp vision**

     Using the Snellen card to determine the sharpness of vision in DM patients and the results are set in the 6/6, 6/50 and so on metrics. In addition to using a Snellen card, you can also use **a MAR** (logarithm of the Minimun Angle of Resolution) log card. (Ministry of Health of the Republic of Indonesia, 2023)
   - **Slit lamp biomicroscopy**

     This examination aims to assess the condition of the anterior segment of the eyeball. In DM patients, neovascularization of the iris is usually found. (Ministry of Health of the Republic of Indonesia, 2023)
   - **Tekanan intraocular (TIO)**

     An intraocular pressure check (TIO) is performed to assess the presence of increased eyeball pressure that can lead to glaucoma. In patients with diabetes mellitus, this examination is important because high blood sugar levels can affect intraocular fluid flow and increase the risk of glaucoma, including the neovascular type that is common in proliferative diabetic retinopathy (Kanski & Bowling, 2020; AAO, 2021).
   - **Gonioscopes**

A gonioscopy examination is used to evaluate the angular condition of the front eye chamber. This examination helps determine the type of glaucoma and detect the presence of neovascularization in the corners of the eye chambers, which is often found in advanced stages of diabetic retinopathy. Early detection through gonioscopy is important to prevent the development of neovascular glaucoma that can lead to permanent vision loss (Fu & Chakrabarti, 2022).

- **Wide pupil funduscopy**

  It is an important step in assessing the entire retina, including the macular area and retinal blood vessels. This examination allows early identification of changes typical of diabetic retinopathy, such as microaneurysms, intraretinal hemorrhage, hard exudate, neovascularization, and macular edema. The findings reflect the presence of retinal microvascular damage due to chronic hyperglycemia, which is the basis for the diagnosis and determination of the severity of diabetic retinopathy (Fu & Chakrabarti, 2022).

C. Supporting Examinations:

1. **Fundus photo:** see an overview of the retinal blood vessels and the early signs of damage.
2. **Optical Coherence Tomography (OCT):** detailed visualization of the structure of the retina, especially for detecting macular edema.
3. **Fluorescein Angiography (FA):** effective for assessing the condition of retinal blood vessels, including leaks or bleeding.
4. **Ultrasound (ultrasound):** helps detect deeper complications, such as vitreous hemorrhage.

(Ministry of Health of the Republic of Indonesia, 2023)

Tatalaksana

The general management of diabetic retinopathy is focused on controlling systemic risk factors, especially blood glucose levels and blood pressure, to prevent disease progression. Strict glycemic regulation and blood pressure control have been shown to be effective in lowering the risk of developing diabetic retinopathy in diabetic patients without the findings of retinal abnormalities (American Diabetes Association, 2024; Ting et al., 2022).

Rekomendasi:

1. Kontrol faktor-faktor resiko sistemik pada pasien dengan diabetik makulopati dengan mengontrol tekanan darah dan kontrol glikemik yang optimal
2. Kontrol glikemik yang baik adalah HbA1C kurang dari 7% atau gula darah puasa antara 80-130 mg/dl atau gula darah 2 jam postprandial antara 140-180 mg/dl (*level of evidence* b)
3. Kontrol metabolik lainnya seperti: Hipertensi (diastolik ≤ 90 dan sistolik ≤ 140), Dislipidemia (LDL ≤100) dan TG ≤ 150, DL laki-laki ≥ 40 dan perempuan ≥ 50. (*level evidence* b dan c)
4. Terapi statin untuk Dislipidemia kecuali jika terdapat kontraindikasi medis, dengan pertimbangan penambahan fenofibrat untuk pasien diabetes tipe 2.
5. Skrining retinopati diabetika dilakukan saat pertama kali terdiagnosis pada penderita DM tipe 2, setelah 5 tahun terdiagnosis pada penderita DM tipe 1, dan segera setelah konsepsi atau pada awal trimester pertama pada penderita DM tipe 1 dan 2 yang sedang hamil. Skrining sebagai deteksi awal dilakukan oleh dokter spesialis mata dan dokter umum yang memiliki kompetensi untuk melakukan pemeriksaan segmen posterior dengan funduskopi.

Level of evidence IV, Rekomendasi C

Figure 8. Governance (Ministry of Health of the Republic of Indonesia, 2023)

A. Non-Proliferative Retinopati Diabetika

The severe stage is observation once every six months to see if there are signs of developing proliferative. To prevent the development of a high-risk development into proliferative retinopathy, pan-retinal laser photocoagulation therapy (PRP) can be performed.

B. Proliferative Retinopati Diabetika:

Observations and therapies such as laser photocoagulation, administration of Anti-Vascular Endothelial Growth Factor (Anti-VEGF), intravital steroids, and pars plan virectomy were performed.

Action:

1. Laser Photocoagulation

To increase oxygenation, overcome hypoxia in the inner retina, reduce the stimulus of blood vessel proliferation factors, and reduce neovascularization.

2. Anti-Vascular Endothelial Growth Factor (Anti-VEGF)

To reduce leakage and neovascularization. This anti-VEGF gene will inhibit the formation of neovascularization, help reduce bleeding during surgery and reduce the incidence of recurrent bleeding in the retina after surgery and can sharply improve vision.

3. Steroid intravitreal

   To treat macular edema in diabetic retinopathy patients. The types of corticosteroids used are triamcinolone acetonide, dexamethasone, and fluocinolone acetonide. Triggers the occurrence of cataract complications, increased intraocular pressure and endophthalmitis

4. Virektomi Pars Plana

   For persistent and unreduced vitreous bleeding for one to three months. The purpose of this therapy is to remove all vitreous cortex and fibrovascular tissue and treat the retina if a tear is found in the retina

   (Ministry of Health of the Republic of Indonesia, 2023)

Prevention

Prevention of diabetic retinopathy includes two main approaches, namely primary prevention and secondary prevention. Primary prevention aims to reduce the incidence of diabetic retinopathy in patients with diabetes mellitus through increasing awareness and education about the complications of diabetes, lifestyle changes in a healthier direction, and the implementation of regular eye screening for early detection of retinal disorders. Meanwhile, secondary prevention is focused on efforts to inhibit the progression of diabetic retinopathy in patients who have been diagnosed, by maintaining control of blood glucose levels, blood pressure, and conducting regular funduscopy or retinal photo monitoring. (Purnama et al, 2023)

Complications

Diabetic retinopathy can cause a variety of complications that contribute to a sharp decline in vision to permanent blindness. One of the main complications is diabetic macular edema, which occurs as a result of increased permeability of retinal blood vessels and fluid leakage into the macular area. This condition is the most common cause of vision loss in diabetic patients. In addition, neovascularization of the retina and iris in proliferative diabetic retinopathy can lead to vitreous hemorrhage and neovascular glaucoma, which is characterized by increased intraocular pressure due to obstruction of the angle of the eyespace by abnormal new blood vessels. The progression of the disease can also lead to tractive retinal ablation, which is caused by the pull of fibrovascular tissue against the retina, resulting in irreversible vision loss. In addition, chronic inflammatory processes and oxidative stress play a role in worsening retinal endothelial dysfunction and accelerating the microvascular damage that underlies all these complications (Fu & Chakrabarti, 2022; Gong et al., 2024).

Prognosis

The prognosis of diabetic retinopathy is highly dependent on the severity of the disease, the duration of diabetes, and the patient's adherence to the control of systemic risk factors. Early detection as well as appropriate therapies such as laser photocoagulation and intravitreal anti-VEGF injections have been shown to slow the progression of the disease and lower the risk of blindness. However, in some cases, retinal damage is irreversible, especially when macular ischemia or extensive vitreoretinal fibrosis has occurred. Some patients continue to experience a sharp decline in vision due to persistent diabetic macular complications, despite optimal therapy (Fu & Chakrabarti, 2022; Gong et al., 2024).

CONCLUSION

This study concludes that diabetic retinopathy (DR) is a chronic microvascular complication of diabetes mellitus that significantly impairs vision and causes preventable blindness. It highlights that chronic hyperglycemia triggers endothelial dysfunction, oxidative stress, and inflammation, driving retinal damage progression. Integrating pathophysiological theories with clinical practice, the study underscores the importance of glycemic control and systemic risk factor management in limiting DR severity, contributing valuable insights into Indonesia's diabetic eye disease context. Practically, it advocates early detection via funduscopy and regular screening programs, coupled with patient education and closer collaboration between general practitioners and ophthalmologists to prevent disease progression. For future research, exploring innovations in anti-VEGF therapies and diagnostic biomarkers is recommended to enhance treatment efficacy and preserve vision. Additional investigation into molecular pathways, personalized medicine, and non-invasive early detection technologies could significantly improve clinical outcomes and address current treatment limitations. This comprehensive approach holds promise for advancing DR management and reducing the global burden of diabetic blindness.

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