



A Study Of Diabetics Retinopathy Using Fundus Camera

Padmini.B Ph.d^{1*},Dr.Y.Kalpana²

^{1*}Research Scholar Department of Computer Science VISTAS,Chennai Email:-Pavan26911@gmail.com

²Associate Professor, Department of Information Technology,VISTAS,Chennai
Email:- Ykalpanaravi@gmail.com

***Corresponding Author: Padmini.B Ph.d**

^{*}Research Scholar Department of Computer Science VISTAS,Chennai Email:-Pavan26911@gmail.com

| | <i>Abstract</i> |
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| CC License CC-BY-NC-SA 4.0 | <p>Diabetic retinopathy can only be diagnosed with a full dilated eye exam. Drops in your eyes dilate (enlarge) your pupils so your doctor can see inside your eyes better during the test. In close quarters, the drops may cause blurry vision until they wear off, which might take several hours.Fundus photography can be used to track the progression of retinal disease over time, and it's becoming more used in diabetic retinopathy screenings. Patients with media opacity, such as vitreous haemorrhage or cataract, may benefit from B-scan ultrasonography.</p> <p>Keywords: <i>Diabetic Retinopathy, Nonproliferative diabetic retinopathy, Proliferative diabetic retinopathy,</i></p> |

Introduction:

Diabetic retinopathy is one of the most significant diabetes symptoms, and if left untreated, it can lead to blindness for the rest of one's life. One of the most difficult difficulties is early detection, which is important for treatment effectiveness. Unfortunately, detecting the precise stage of diabetic retinopathy is notoriously difficult and requires human interpretation of fundus images. Diabetic retinopathy (DR) is a major consequence of diabetes that causes retinal damage and finally blindness. It causes fluid leaking and vision distortion by affecting the blood vessels in the retinal tissue. Diabetic retinopathy can only be diagnosed with a full dilated eye exam. Medicines in your eyes dilate (enlarge) your pupils so your doctor can see inside your eyes better during the test.

Diabetic retinopathy:

Diabetic retinopathy (DR) is a chronic, possibly blinding disease of the retinal microvasculature that is linked to diabetes mellitus's persistent hyperglycemia and other diabetes-related disorders like hypertension.

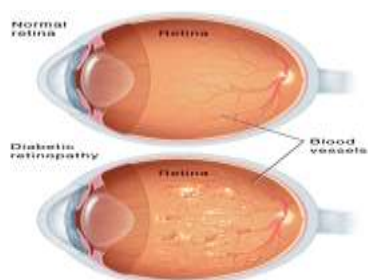


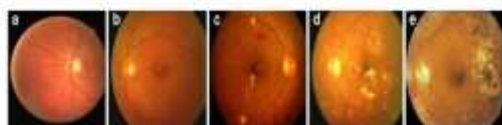
Figure 1: Block diagram for Diabetic Retinopathy

History

Even in the presence of sight-threatening illness, many diabetic retinopathy patients maintain normal vision or have a minor (and sometimes unnoticed) decrease in vision (diabetic maculopathy, proliferative disease).

- Any of the varieties of diabetic retinopathy can cause a painless progressive loss of central vision. Cataract growth is also linked to painless and progressive vision loss (diabetic or otherwise).
- Haemorrhages cause black, harmless floaters to appear suddenly and disappear over several days.
- A severe haemorrhage can completely obliterate the vitreous, resulting in a painless vision loss.
- The only time a patient will come with acute pain is if they have glaucoma caused by rubeosis iridis (see 'Eye disorders less usually related with diabetes', below).

Stages of Diabetic Retinopathy



(a) normal (b) mild DR (c) moderate DR
(d) severe DR (e)proliferic DR

Figure 2: Stages of Diabetic Retinopathy

Types of diabetic retinopathy:

There are four phases of diabetic retinopathy (DR)..

- Mild Nonproliferative diabetic retinopathy (NPDR),
- Moderate Nonproliferative diabetic retinopathy,
- Severe nonproliferative diabetic retinopathy, and
- Proliferative diabetic retinopathy (PDR).

Mild nonproliferative diabetic retinopathy (NPDR):

Background retinopathy is the term for the first stage. It indicates that the tiny blood vessels in your retinas have bulges in them. Microaneurysms refer to the bulges. Small amounts of blood may flow into your retinas as a result of them. You might not need therapy at this point because you don't have any vision problems. Consult your doctor for advice on how to prevent your illness from worsening. Your blood sugar, blood pressure, and cholesterol levels must all be kept under control. In the next 12 months, you should schedule another screening test. If you have this problem in both eyes, you have a 25% probability of moving to the third stage in the next three years, according to the doctor.

Moderate nonproliferative diabetic retinopathy:

They may not be as effective at transporting blood as they once were. Physical changes to the retina may result from these factors. Diabetic macular edema is a result of these alterations (DME). This occurs when blood and other fluids accumulate in the macula, a small area of your retina. Pre-proliferative retinopathy refers to the second stage of the disease. Your retinas' blood vessels swell at this point. They may not be as effective at transporting blood as they once were. Physical changes to the retina may result from these factors.

Diabetic macular edema is a result of these alterations (DME). This occurs when blood and other fluids accumulate in the macula, a small area of your retina. When you read or drive, the macula is crucial for straight-ahead vision.

Types of image processing

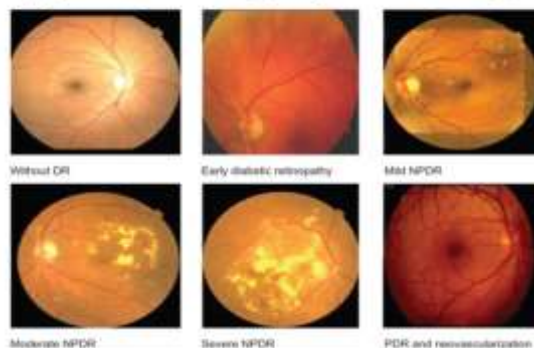


Figure 3: Types of image processing

Severe Nonproliferative diabetic retinopathy

This is also called proliferative retinopathy. In this stage, your blood vessels become even more blocked. This means even less blood goes to the retinas. Because of this, scar tissue forms. The lack of blood sends a signal to your retinas, instructing them to form new blood vessels.

Macular ischemia occurs when the blood arteries in the retina close entirely. This might cause hazy vision and black specks known as "floaters" by certain people.

There's a good probability you'll lose your vision if you get to this point. Treatment may be able to halt the progression of visual loss. However, if you've already lost some vision, it's unlikely to return.

A larger section of the retina's blood arteries becomes clogged, reducing blood flow to this area significantly. At this time, the body receives signals to start forming new blood vessels in the retina. Non-proliferative diabetic retinopathy is the initial phase of diabetic retinopathy (NPDR). The retina's blood vessels are weakened. Microaneurysms, or small bulges in blood vessels, can leak fluid into the retina. As a result of the leakage, the macula may swell.

Proliferative diabetic retinopathy (PDR):

Proliferative retinopathy is another name for this condition. Your blood vessels get considerably more clogged at this point. As a result, even less blood reaches the retinas. As a result, scar tissue develops. The lack of blood sends a signal to your retinas, instructing them to form new blood vessels.

Macular ischemia occurs when the blood arteries in the retina close entirely. This might cause hazy vision and black specks known as "floaters" by certain people. There's a good probability you'll lose your vision if you get to this point. Treatment may be able to halt the progression of visual loss. However, if you've already lost some vision, it's unlikely to return. A bigger section of the retina's blood arteries becomes clogged, resulting in a severe reduction in vision.

Early diabetic retinopathy

You may not need therapy right away if you have mild or moderate nonproliferative diabetic retinopathy. Your eye doctor, on the other hand, will keep a close eye on your eyes to see if you require therapy.

Consult your diabetes doctor (endocrinologist) to see if there are any changes that may be made to your diabetes care. Good blood sugar control can usually decrease the growth of diabetic retinopathy when it is mild or moderate.

A retina, or fundus camera, is used for fundus photography:

The lenses on this highly specialised 35mm or digital camera are meant to focus on the structures of the back of the eye. It's essentially a camera mounted atop an eye "microscope." Fundus photography is a technique for documenting and diagnosing specific eye disorders.

The inside or back of the eyeball is referred to as the "fundus." A typical fundus photograph would show the retina, which is the very rear inner wall of the eye. In a normal fundus photograph, the optic nerve, macula, and main retinal blood veins are visible. Also also the animation "Interactive Human Eye." Fundus

photography is extremely beneficial for documenting the natural state of the back of the eye in order to provide the most accurate diagnosis possible.



Figure 4: Fundus Camera

Fundus photography is extremely important for documenting the natural state of the back of the eye and providing a future reference for the retinal expert to compare with during follow-up visits. Most retinal diseases and conditions require documentation, including diabetic eye disease, macular degeneration, epiretinal membranes, macular holes, and retinal tears and detachment.

Fluorescein angiography (FA) is a diagnostic procedure that involves using fundus photography to record images of injected dye moving within the retinal blood vessels. This is a very useful research that can reveal leaking, swelling, or circulation issues caused by a variety of eye illnesses, such as diabetic retinopathy and wet macular degeneration.

Smartphone features that impair fundus concentrating :

These elements influence the image quality and ease of concentrating the retina while modifying the filming distance.

The camera lens is located on the smartphone's backside. A flashlight's position in regard to the camera lens. The camera lens is usually found in the phone's corner, while the fundus image is displayed in the phone's centre. Because of the difference in location between the camera lens and the display screen, movements are required to concentrate the fundus image in the display screen's centre .

In terms of a flashlight's proximity to the camera lens, the closer the flashlight is to the lens, the easier it is to focus.

Advanced diabetic retinopathy

You should get treatment right once if you develop proliferative diabetic retinopathy or retinal edoema. Options may include: Depending on the nature of your retinal abnormalities, you may be able to:

- Medications injected into the eyeball. VEGF inhibitors are drugs that are injected into the vitreous of the eye. They aid in the prevention of new blood vessel formation as well as the reduction of fluid retention.

The Food and Drug Administration (FDA) has approved ranibizumab (Lucentis) and aflibercept for the treatment of diabetic macular edoema (Eylea). Bevacizumab (Avastin), a third medication, can be used for diabetic macular edoema off-label.

Topical anaesthetic is used to administer these medications. For the next 24 hours after the injection, you may experience slight discomfort such as burning, ripping, or soreness.

- Photocoagulation. This laser treatment, also known as focused laser treatment, can help to stop or delay blood and fluid leaking in the eye. Laser burns are used during the operation to correct leakage from aberrant blood vessels.

A single focused laser therapy session is usually performed at your doctor's office or an eye clinic. If you have macular edoema and had blurry vision before to surgery, the treatment may not be able to restore your vision, but it will likely reduce the likelihood of the macular edoema worsening.

- Photocoagulation of the whole retina. The aberrant blood vessels can be shrunk by this laser treatment, also known as scatter laser treatment. The portions of the retina farthest from the macula are treated with scattered laser burns during the process. The abnormal new blood vessels shrink and scar as a result of the burns.

It's normally done in two or more sessions at your doctor's office or an eye clinic. For about a day after the surgery, your vision will be blurry. It's likely that you'll lose some peripheral vision or night vision as a result of the treatment.

- Vitrectomy. A small incision is made in your eye to remove blood from the vitreous and scar tissue that is putting strain on the retina. It's done in either a surgical centre or a hospital.

Symptoms

In the early stages of diabetic retinopathy, you may not notice any symptoms. As the illness worsens, you may experience:

- Floaters (spots or dark strings floating through your eyesight)
- Blurred vision
- Shifts in eyesight
- Areas of your vision that are dark or vacant
- Loss of vision

Risk factors

Diabetic retinopathy is a condition that can affect anyone who has diabetes. The following things can increase your risk of developing the condition:

- Diabetes that has been present for a long time.
- An inability to control blood sugar levels.
- Hypertension (high blood pressure).
- A high level of cholesterol.
- Being of African-American, Hispanic, or Native American ancestry.
- Being a pregnant.

Complications

Diabetic retinopathy is a condition in which blood vessels in the retina grow irregularly as a result of diabetes. Complications can cause serious vision problems, including:

- Hemorrhage in the vitreous. It's possible that the new blood vessels will leak into the transparent, jellylike fluid that fills your eye's centre. Only a few dark spots may appear if the amount of bleeding is minor (floaters). Blood can fill the vitreous cavity and completely block your vision in more severe cases.
- In most cases, a vitreous haemorrhage does not result in permanent vision loss. Within a few weeks or months, the blood in the eye usually clears. Your vision will most likely recover to its previous sharpness unless your retina is injured.
- Detachment of the retina. Diabetic retinopathy causes aberrant blood vessels to form, causing scar tissue to grow and pull the retina away from the back of the eye. This can result in floating dots in your vision, bright flashes, or serious vision loss.
- Glaucoma. New blood vessels can form in the iris (front part of the eye) and obstruct the usual flow of fluid out of the eye, causing pressure to build up in the eye. The nerve that transmits images from your eye to your brain can be damaged by this pressure (optic nerve).
- Blindness. Diabetic retinopathy, macular edema, glaucoma, or a combination of these disorders can result in total vision loss, especially if they are not treated properly.

Prevention

Diabetic retinopathy is a condition that cannot always be avoided. On the other hand, regular eye exams, good blood sugar and blood pressure control, and early detection and treatment of visual abnormalities can all assist to prevent serious vision loss.

If you have diabetes, do the following precautions to lower your risk of diabetic retinopathy:

- Monitor your blood sugar levels. Make it a habit to eat well and exercise regularly. Aim for 150 minutes of moderate aerobic activity, such as walking, per week. Follow the directions on the label of your diabetes medication or insulin.
- Monitor your blood sugar levels. You may need to check and record your blood sugar level several times a day if you're unwell or worried. Consult your doctor to find out how often you should check your blood sugar.

How does diabetes lead to diabetic retinopathy?

The precise mechanism through which diabetes causes diabetic retinopathy is unknown. Retinal ischaemia is caused by microvascular obstruction, which leads to arteriovenous shunts and neovascularization. Intraretinal

haemorrhages and localised or widespread oedema are caused by leakage. These processes produce the following characteristics in diabetic retinopathy at various stages:

- Microaneurysms - a physical weakening of capillary walls that makes them vulnerable to leaking.
- Hard exudates - lipoprotein/other protein precipitates seeping from retinal blood vessels.
- Haemorrhages - little dots/larger blots or 'flame' haemorrhages that track along nerve-fibre bundles in the superficial retinal layers, caused by compromised capillaries (the haemorrhage arises from larger and more superficial arterioles).
- Cotton wool patches - a build-up of axonal debris at the edges of ischemic infarcts due to inadequate axonal metabolism.
- Neovascularisation - an attempt (by the patient) to re-establish blood flow in the body.

Adults with diabetes type 1 or type 2

Adults with type 1 or type 2 diabetes should have their eyes checked at or near the time of diagnosis. Annually, repeat the structured eye screening. When imaging the retina, use mydriasis with tropicamide after previous informed consent and discussion of the benefits and drawbacks. Precautions for driving should be discussed.

- Use a high-quality digital retinal photography programme with properly trained personnel. As part of routine eye screening programmes, conduct visual acuity testing. Follow structured eye screening with a one-year review, an early evaluation, or a referral to an ophthalmologist, depending on the findings.
- Sudden loss of eyesight. Make an appointment with an ophthalmologist for an emergency evaluation.

Rubeosis iridis is a kind of rubeosis.

- Vitreous or pre-retinal bleeding
- Detachment of the retina.
- Make an appointment with an ophthalmologist very away to check for new vessel formation.
- If any of these features are present, consult an ophthalmologist according to the National Screening Committee standards and deadlines (referred to the hospital eye services within four weeks of the result)

Maculopathy that can be referred

- Exudate or thickening of the retina within 1 disc diameter of the fovea's centre.
- Circinate exudates or a collection of exudates within the macula (the macula is defined here as a Circle centred on the fovea, with a diameter the distance between the temporal border of the optic disc and the fovea).
- Any haemorrhage or microaneurysm within 1 disc diameter of the centre

Any type of venous beading.

- Any reduplication of the veins.
- Any microvascular anomalies within the retina.
- Multiple haemorrhages that are deep, circular, or blotchy.
- Any significant, rapid, and inexplicable decrease in visual acuity.

Children and young adults

For both type 1 and type 2 diabetes, monitoring for diabetic retinopathy should begin at the age of 12 years. If blood glucose control is poor, consider referring children and young people with type 2 diabetes under the age of 12 to an ophthalmologist for a retinal examination.

Conclusion:

Diabetic retinopathy is now understood to be an inflammatory neuro-vascular consequence of the systemic disease, with neuronal injury/dysfunction occurring before clinically observable microvascular damage, and is also a sign of inflammatory tissue death in other organs. Periodic ophthalmoscopic examinations are essential for detecting retinopathy progression and the appearance of disease characteristics that indicate the necessity for treatment. The Collaborative Diabetic Retinopathy Vitrectomy Study and the Early Treatment Diabetic Retinopathy Study at the National Eye Institute, as well as research into vasoformative variables, should help us understand more about diabetic retinopathy in the future.

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