

# Preventing blindness from diabetic retinopathy through community screening

**Wani G Mena**

Chief Ophthalmologist and  
Head of Eye Department.  
Juba Teaching Hospital.

**Correspondence:**

Wani Mena [wanimena@gmail.com](mailto:wanimena@gmail.com)

## INTRODUCTION

Diabetic retinopathy (DR) is the commonest microvascular complication of diabetes and a leading cause of blindness in working age adults. The global prevalence of diabetic retinopathy is estimated at 34% and varies from region to region.<sup>[1]</sup> Its prevalence is increasing in Sub Saharan Africa and other low and middle income countries, fuelled by the increasing number of people living in poverty with diabetes, poor control of blood sugar, lipids and blood pressure as well as lack of services for early detection and treatment of DR.<sup>[2]</sup>

Blindness from DR is preventable through early detection and treatment of the sight threatening stages of retinopathy. However, many diabetic patients are not aware that they have retinopathy or that it can cause blindness. Patients therefore do not present to health care providers until symptoms appear, by which time treatment cannot restore lost sight. Symptoms only develop at a late stage in the disease and even patients with good diabetic control may develop retinopathy.

Screening diabetic patients for retinopathy enables early detection and referral for treatment as well an opportunity for education about those risk factors which can be modified by treatment or behavioural change. At a screening examination patients can be told of the importance of maintaining normal blood glucose, blood pressure and serum lipids as well as regular checks of glycosylated haemoglobin (HbA1C) level ensuring that it is below 7%.

The purpose of this article is to create awareness among health workers and their patients that diabetes can cause irreversible blindness through development of retinopathy, that we can prevent this type of blindness through regular annual examination of those without retinopathy or more frequent examination and treatment of those with detected retinopathy and that early screening and treatment is cheaper than treating and rehabilitating the blind.

## WHAT IS DIABETIC RETINOPATHY?

Diabetic retinopathy is a microangiopathy affecting retinal capillaries and venules that occurs in a response to persistent hyperglycaemia. It also affects the small vessels of the heart, kidney and brain as well as those supplying peripheral nerves.

Structural weakness of the wall of the capillaries results in development of aneurysms, exudation of plasma fluid and bleeding on the retinal surface.<sup>[3]</sup> Intra-retinal fluid can accumulate in the macular and is known as macular oedema. Damage to capillary wall also results in occlusion mainly due to platelet aggregation. This causes retinal ischemia and results in release of vascular endothelial growth factors that stimulate growth of new vessels.<sup>[4]</sup> New vessels develop on the posterior hyaloid face, the iris and in the angle causing vitreous haemorrhage, retinal detachment and neovascular glaucoma.

Diabetic retinopathy progresses through different stages before vision is affected. The purpose of screening is to identify those stages that threaten the person's sight and recommend treatment as early as possible.

### Stages of diabetic retinopathy

#### 1. Non proliferative diabetic retinopathy (NPDR)

NPDR is the earliest stage of retinopathy and is characterized by presence of

### Citation:

Mena. Preventing blindness from diabetic retinopathy through community screening. South Sudan Medical Journal 2019; 12(2):52-57

© 2019 The Author (s)

### License:

This is an open access article under

[CC BY-NC-ND](https://creativecommons.org/licenses/by-nc-nd/4.0/)

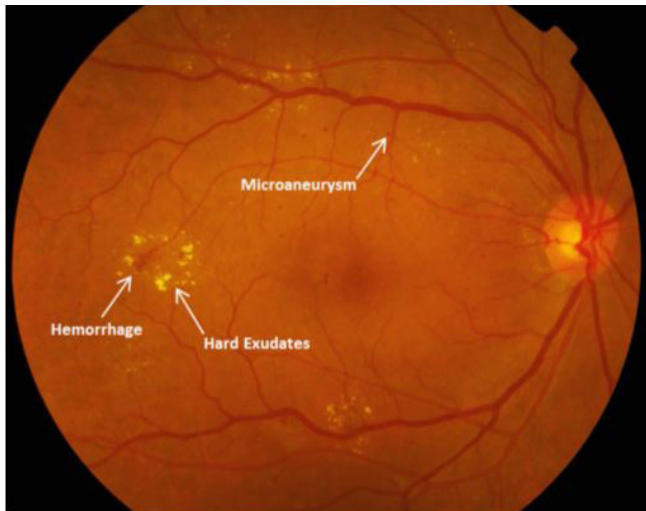


Figure 1a Non proliferative diabetic retinopathy  
(Credit [International Council of Ophthalmology Guidelines](#))



Figure 1b. Pre-proliferative diabetic retinopathy – venous looping  
(Credit [International Council of Ophthalmology Guidelines](#))

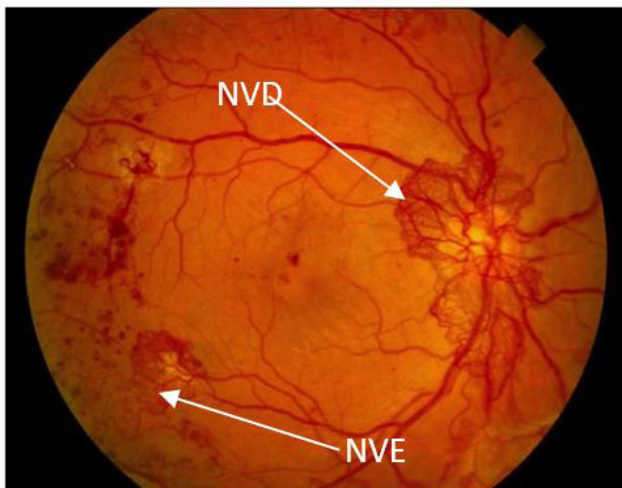


Figure 2a. Proliferative Diabetic Retinopathy  
(Credit [Diabetic retinopathy photos American Academy of Ophthalmology](#))



Figure 2b. Intra-retinal and pre-retinal haemorrhages  
(Credit [Diabetic retinopathy photos American Academy of Ophthalmology](#))

micro aneurysms, dot and blot haemorrhages and hard exudates (Figure 1a). As retinopathy progresses, more severe signs of non-proliferative retinopathy (referred to as pre-proliferative diabetic retinopathy) appear. These includes cotton wool spots and venous caliber changes (venous dilation, segmentation and looping) (Figure 1b). When detected early through screening pre-proliferative stage of NPDR can be treated to prevent its progression to proliferative diabetic retinopathy.

## 2. Proliferative diabetic retinopathy (PDR)

This stage is characterized by all the above signs plus new vessels growing at the disc or elsewhere (Figure 2a). This is a sight threatening stage of retinopathy which can progress to intra-retinal and pre-retinal haemorrhages (Figure 2b).

## 3. Macula oedema

Hard exudates and haemorrhages in the macula region with thickened retina (within 1DD of the fovea) is referred to as central macula oedema (DMO) and is a threat to vision (Figure 3). Macular oedema can occur independently of NPDR or PDR.

## 4. Sight threatening diabetic retinopathy (STDR)

Detection of macula oedema or proliferative diabetic retinopathy or both is a threat to patient's vision either because of haemorrhage, tractional retinal detachment or macula oedema. These patients need referral for urgent treatment with laser or injection of anti VEGF.

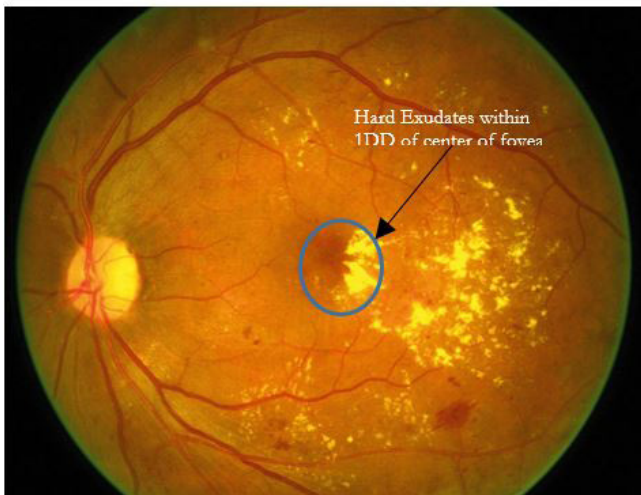


Figure 3. Significant macula oedema (hard exudates within 1 DD of the fovea) (Credit International Council of Ophthalmology Guidelines)

## HOW TO SCREEN FOR DIABETIC RETINOPATHY

There are two approaches to screening for DR:

**Systemic screening** is the method applicable in resource adequate settings where diabetics can be identified through a data base or through their family practitioners who maintain adequate records of all diabetics visiting their clinics. These patients can then be invited for screening examinations at intervals as required by the stage of their retinopathy. Screening can also be done in remote areas to screen diabetics using mobile equipment.

**Opportunistic screening** is applicable in resource limited settings where screening examination is limited to those who can come to a diabetic clinic, ophthalmologist or optometry surgeries where they may be examined as part of eye examination. In some cases, some of these patients can be given a schedule of eye examinations by the practitioner. People who live in rural areas or who are unable to afford visit to clinics will be missed out.

In either method of screening, the number of people with diabetes who will need to be examined need to be known. To calculate this we need to know the size of the population of those aged 20 years and older in the country or district. (available from census records). Then we need to know the proportion of this population who have diabetes (available from diabetes atlas) lastly we need to calculate the proportion of people with diabetes who have sight threatening diabetic retinopathy. This is estimated to be 10% for low income countries.<sup>[5]</sup>

A screening examination involves examination of the retina through fundoscopy. This usually requires the skill of the ophthalmologist or an ophthalmic nurse trained

in the technique of fundoscopy. Direct ophthalmoscopy with a hand-held direct ophthalmoscope is easy and can be performed by a trained nurse; however it is not possible to see to the periphery with direct ophthalmoscopy and some peripheral lesions may be missed. Use of binocular indirect ophthalmoscope or a Slit lamp with bio-microscopic lens gives a wide magnified view of the fundus and enables assessment of the presence of oedema of the macula. The equipment is expensive and the skill of the ophthalmologist is required which presents a human resource limitation to screening.

Equipment required for screening for diabetic retinopathy:

1. Direct and indirect ophthalmoscope
2. Slit lamp and bio microscopic lens
3. Fundus camera
4. Facilities for fluorescein angiography.

### Screening for DR at primary health care level

Depending on the personnel and equipment available, fundus examination with a direct ophthalmoscope may be possible at this level. Otherwise basic history taking and measurement of visual acuity is all that is required for referral to be initiated.

Record the following during history taking: patient's age, the age at which diagnosis of diabetes was made, duration of diabetes, type of diabetes, current treatment, last-recorded blood sugar and glycosylated haemoglobin and whether systemic disease such as hypertension, heart and kidney disease is present. Weight, height and blood pressure should be measured and body mass index calculated.

Referral for diabetic retinopathy evaluation at the primary care level should be based on the type and duration of diabetes.

1. Refer type 1 diabetics for retinal assessment 5 years after initial diagnosis of diabetes.
2. Refer type 2 diabetics when diagnosis is made as the diabetes may have been present for a long time and some patients may already have retinopathy at the time of the initial diagnosis.

Before referral counsel the patients and give education about diabetes and its complication particularly eye complications. Patients must know that diabetes can affect the eye and can cause blindness, but that the blindness from diabetes can be prevented if it is detected and treated early. So it is important for patients to come for eye examinations, even if they feel well and have good vision. Referral to secondary care should include anybody with vision less than 6/18 and anyone with features of diabetic retinopathy or maculopathy.

### Screening for DR at secondary level of health care

At this level resources for diagnosis may include an ophthalmologist and ophthalmic nurses, and equipment such as a slit lamp with bio microscopic lens and an indirect ophthalmoscope. There may be a fundus camera which is the best equipment for screening for diabetic retinopathy as it gives a permanent record of the fundus. When a systematic programme of screening is underway in a district, the camera can become mobile and take photos in the community. Photos are then graded by a multiple

graders according to internationally agreed standards and only those with sight threatening features need to travel to the main secondary centre. In South Sudan, there is only one such fundus camera available at Buluk eye clinic in Juba. However with newer technology such as the PEEK adapter it is now possible to take retinal photos with mobile phones which may make developing a diabetic screening service more feasible and practical.

At this level all the processes undertaken at the primary care level are performed and then the patient is examined

**Table 1. Treatment decisions and patient advice on management of diabetic retinopathy at secondary level**

Stage of retinopathy	Signs	Advice to patients
<b>Background diabetic retinopathy</b> Mild to moderate non proliferative diabetic retinopathy (NPDR)	Aneurysms, haemorrhages, hard exudates	Diabetes is starting to damage your eyes although your vision is still good. return for eye examination within 12-6 months (12 months in mild retinopathy, 6 months in moderate retinopathy) Ensure that your blood pressure, glucose, and cholesterol are controlled Take your medications and, exercise regularly, eat a healthy (food plate containing ½ vegetables, ¼ carbohydrates and ¼ proteins). Avoid fizzy drinks
<b>Pre-proliferative diabetic retinopathy</b> Severe Non proliferative diabetic retinopathy (NPDR)	All the above plus cotton wool spots, venous calibre changes (venous dilation, segmentation and looping), IRMA	Diabetes has damaged your eyes although your vision may still be good. You will need Laser treatment to ensure that these changes do not progress to proliferative stage which would increase your risk of losing vision. Laser treatment will maintain rather than improve the current vision
<b>Proliferative diabetic retinopathy</b>	All the above plus new vessels at the disc (NVD) or elsewhere (NVE), Intra-retinal and pre-retinal haemorrhages	Diabetes has damaged your eyes severely and your vision has gotten worse. You need urgent treatment to prevent further loss of sight.
<b>Maculopathy</b>		
No macula oedema	No haemorrhage, exudates or retinal thickening in the macula region	Review in 12 months, maintain normal blood pressure, blood sugar and cholesterol, perform regular exercise and eat healthy diet
Non centre involving macula oedema	Haemorrhages, hard exudates or retinal oedema >1DD from centre of fovea	Diabetes has damaged your eyes severely. Your vision may be good now but it may get worse in future. You need laser treatment to stop it getting worse. Treatment will preserve but not improve present vision
Centre involving macula oedema	Exudates or retinal thickening within 1DD of the centre of the fovea	Diabetes has damaged your eyes severely and your vision has got worse. You need urgent treatment with anti VEGF injections to prevent further loss of sight.

**Table 2. Management of cataract in a diabetic with or without diabetic retinopathy**

Assessment	Signs	Decision on surgery
No diabetic retinopathy	No retinopathy	Proceed with cataract surgery
Mild to moderate diabetic retinopathy	Hard exudates, haemorrhages, no significant macula oedema	Proceed with cataract surgery
Severe non proliferative diabetic retinopathy	Cotton wool spots, venous calibre changes, venous loops	1. Fundus visible: treat with laser before surgery 2. Fundus not visible: Retinal surgeon give endolaser immediately after cataract extraction before lens implantation No retinal surgeon, then administer laser in the immediate postoperative period
Proliferative diabetic retinopathy	New vessels at disc or macula	Laser treatment or anti VegF injections before cataract surgery
Macula oedema	Haemorrhage, hard exudates or retinal thickening 1DD to fovea	Anti VEGF injections to ideally stabilise before cataract extraction but can be done with cataract surgery if access to services is limited.

with a slit lamp with bio microscopy. Any retinopathy observed is graded and the patient classified. The main intention is to detect signs of sight threatening diabetic retinopathy and, if present, refer for treatment.

The two signs of sight threatening diabetic retinopathy which must be detected on screening are macula oedema and new vessels at the disc or elsewhere. These two lesions cause loss of vision in a diabetic patient through retinal bleeding and accumulation of fluid at the macula. Patients with sight threatening diabetic retinopathy must be referred urgently for laser or anti VEGF injections.

To prevent vision loss from PDR laser treatment can be applied to the peripheral retina to preserve the central retina. This is called pan-retinal photocoagulation. Focal or diffuse argon laser is also done for macular oedema. Serial monthly intravitreal injections of Anti-VEGF are a significant advancement in the care of diabetic eyes but is rarely affordable in a low resource setting.

At this level patients are informed about the findings of their fundus examination, counselled about the stage of the retinopathy and advised what action to take in order to protect their sight. Table 1 is adapted from Community Eye Health Journal 2015:28(92).<sup>[6]</sup>

### **TERTIARY CARE FOR DIABETIC RETINOPATHY**

Screening for diabetic retinopathy will be unproductive

unless facilities for surgical treatment of diabetic retinopathy are in place. This means availability of equipment for Laser, anti VEGF and vitrectomy treatment as well as OCT for diagnosis and follow up of treatment progress. In South Sudan patients requiring treatment for sight threatening diabetic retinopathy have to be referred abroad. It may appear an unsurmountable obstacle to overcome for a country burdened by infectious disease, poverty and wars to even think of putting up such a facility, but the cost of these overseas referrals surely outweigh that of setting up and maintaining these unit.

### **DIABETIC RETINOPATHY IN PREGNANCY**

Patients with diabetes who are pregnant or are planning to become pregnant should be assessed for retinopathy in the first trimester of pregnancy and at 28 weeks of gestation if the initial assessment was normal. However, if retinopathy was detected at the initial examination then another assessment should be scheduled at 16-12 weeks. Blood sugar must be controlled at all times during the duration of pregnancy. General Practitioners, midwives and obstetricians must refer patients for assessment as soon as pregnancy is detected.

### **MANAGEMENT OF CATARACT IN A DIABETIC PATIENT**

Cataract is the commonest anterior segment complication of diabetes. The majority of patients with diabetes will have cataract at some point in the course of diabetes and

this will require surgery at some stage. Cataract surgery can hasten the progression of diabetic retinopathy especially if surgery is complicated by capsule break or vitreous loss. Before undertaking cataract extraction in a diabetic patient retinal assessment to detect retinopathy should be undertaken and a decision taken as shown in Table 2.

### **RELATIONSHIP OF DIABETIC RETINOPATHY TO SYSTEMIC CONDITIONS**

Patients with proliferative diabetic retinopathy may be suffering from heart disease, or nephropathy. They are therefore prone to developing renal failure, ischemic heart disease and stroke and should be promptly referred for ECG, Echo cardiography and renal assessment.

### **CONCLUSION**

The prevalence of diabetes is growing rapidly in resource poor countries due to life style changes, migration to cities, poverty and lack of health care facilities. Blindness due to diabetic retinopathy is also increasing although it is a preventable condition. The key to preventing blindness is through early detection of retinopathy by screening, detection and early treatment of the sight threatening form of retinopathy. Health education on the need for regular eye examinations even in those without symptoms will prevent this needless loss of sight. Further, patients need to know that maintaining a near normal blood glucose, stable blood pressure, healthy weight and low cholesterol can delay the onset and slow the progression of diabetic retinopathy. The Government of South Sudan needs to do more to invest in facilities for screening and treatment of diabetic retinopathy.

### **References**

1. Tien Y Yong et al. Global prevalence and risk factors of diabetic retinopathy, *Diabetes Care* 2012; 35:556-564
2. Burgess PI, MacCormic JC, Harding SP et al Epidemiology of diabetic retinopathy and maculopathy in Africa: a systematic review. *Diabet. Med* 2013; 30:399-412
3. International Council of Ophthalmology (ICO) guidelines for management of diabetic retinopathy, revised 2017.
4. Benson WE, Brown GC, William Tasman T. *Diabetes and its ocular complications* (64-89) 1988: WB Saunders Company. Harcourt Brace Jovanovick Inc.
5. Forster A. Planning programmes to prevent visual loss from diabetic retinopathy. *Comm. Eye Health J* 2015; 28 (92):1-5
6. Diabetic retinopathy DR: Management and referral. *Comm. Eye Health J* 2015; 28(92):70-71; published online April 2016.

### **Other useful resources**

- [Diabetic retinopathy \(DR\): management and referral](#)
- [Empowering patients with diabetic retinopathy](#)
- [Planning a programme to prevent visual loss from diabetic retinopathy](#)
- [A3 poster with diabetic retinopathy \(DR\) grading system](#)