Community Eye Health JOURNAL

Now with CPD
See page 23

International Centre for Eye Health

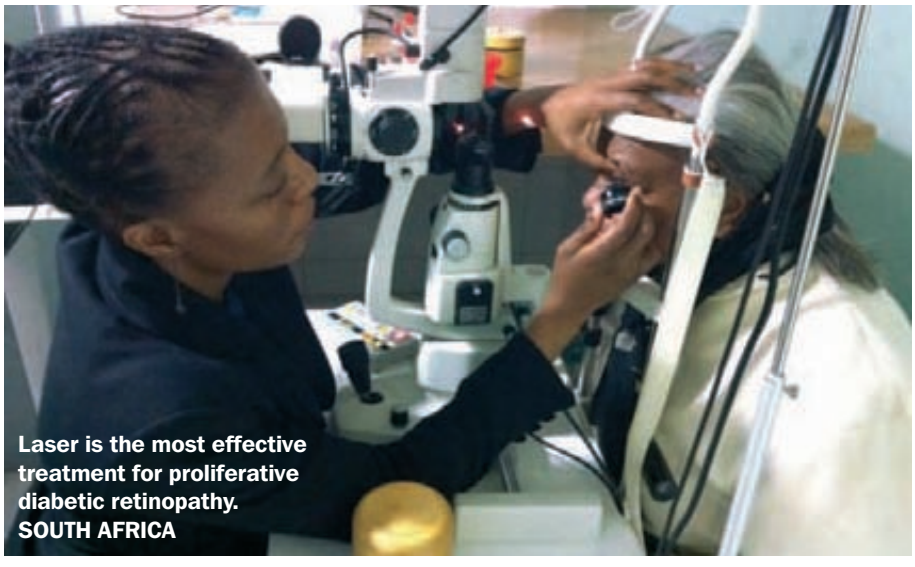
VISION 2020 THE RIGHT TO SIGHT

VOLUME 24 | ISSUE 75 | SEPTEMBER 2011

Diabetic retinopathy: everybody's business

Iris Winter
Consultant, Universitätsklinik und Poliklinik für Augenheilkunde/ Department of Ophthalmology at University Hospital, Halle (Saale), Ernst-Grube Str. 40, 06120 Halle (Saale).
Email: winteriris02@yahoo.com

David Yorston
Consultant Ophthalmologist, Tennent Institute of Ophthalmology, Gartnavel Hospital,1053 Great Western Road, Glasgow G12 0YN, UK.



Laser is the most effective treatment for proliferative diabetic retinopathy. SOUTH AFRICA

Elmien Wolvaardt Ellison

Diabetes is on the increase worldwide, due mainly to the rise in the number of people with type 2 diabetes. Type 2 diabetes is becoming more common because:

- People are living longer, and diabetes is more prevalent in older people.
- As people increasingly migrate to urban areas, exercise less, eat more, and eat less healthy food, more people are becoming obese – a primary cause of type 2 diabetes.

Diabetes increases the risk of a range of eye diseases, including cataract, but the main cause of blindness associated with diabetes is diabetic retinopathy (DR). DR usually develops between ten and twenty years after the onset of diabetes, and develops faster when diabetes is undiagnosed and untreated.

People with DR whose sight is at risk can be treated, most commonly with laser, to prevent visual impairment and blindness. Sadly, there is no treatment that can restore vision that has already been lost.

In 2030, the number of people with diabetes is expected to increase to 440 million, 54% more than in 2010. This means that, for every two people with diabetes today, there would be three in 2030. But there will be a far greater increase in some of the world's poorest regions (Table 1, overleaf). In sub-Saharan Africa, for example, the expected increase is 98%, which means the number of people with diabetes there would double.

As the prevalence of diabetes increases, so will the risk of DR. In 2002, the global average risk of blindness from DR amongst people with diabetes was calculated as 0.75% – meaning that, out of every 133 people with diabetes, one person will go blind. If we simply apply this statistic to the expected number of people predicted to have diabetes in 2030 (440 million), the number of people likely to go blind from DR would be 3.3 million.

In the poorest regions, however, the average risk of blindness from DR tends to be higher than 1 in 133. An important reason for this is that the infrastructure and resources required to effectively address DR are either inadequate or

Continues overleaf ➤

In this issue

Community Eye Health JOURNAL

Supporting VISION 2020: The Right to Sight

International Centre for Eye Health

Volume 24 | Issue 75 | September 2011

Subscriptions and back issues
Community Eye Health Journal, International Centre for Eye Health, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK.
Tel +44 207 612 7964/72
Fax +44 207 958 8317
Email admin@cehjournal.org

The *Community Eye Health Journal* is sent **free to applicants from low- and middle-income countries**. French, Spanish, Portuguese, and Chinese translations are available and a special supplement is produced for India (in English). Please send details of your name, occupation, and postal address to the *Community Eye Health Journal*, at the address above. Subscription rates for applicants elsewhere: one year UK £50; three years UK £100. Send credit card details or an international cheque/banker's order made payable to London School of Hygiene and Tropical Medicine to the address above.

ISSN 0953-6833

absent. For example, in one recent survey in Central America, 1.2% of people with diabetes were blind from DR (around 1 in 84).

In this respect, the current projections of the future global increase in blindness from DR appear optimistic, and the number people likely to become blind as a result of DR in 2030 could be much higher than 3.3 million.

Fortunately, because of the ten- to twenty-year delay in the onset of DR, we still have a small window of opportunity to put systems, equipment, and people in place now to cope with, and wherever possible prevent, the epidemic of DR that is likely to affect the poorest countries a decade or so from now.

> **'Diabetes – and diabetic retinopathy – can be avoided by making healthier lifestyle choices'**

What can we do?

Many readers of this journal are ophthalmic nurses or medical assistants, and some may feel that DR is a complicated problem which should be left to programme managers or ophthalmologists to address. However, there is a great deal that all eye care workers and their health care colleagues can do to address DR, by supporting each of the following:

- prevention of diabetes
- early diagnosis of diabetes
- good control of blood sugar and blood pressure amongst people with diabetes
- early diagnosis of DR
- referral for treatment.

Prevention of diabetes. At the primary care level, we can emphasise the importance of a healthy diet and exercise, since much of the increase in diabetes is a result of increasing obesity. Eye workers should join with other health workers to emphasise that diabetes – and diabetic retinopathy – can be avoided by making healthier lifestyle choices.

Early diagnosis of diabetes. The people who are blind from DR today are the same people whose diabetes was undiagnosed or poorly controlled ten years ago. We know that early diagnosis of diabetes followed by good control of blood sugar and blood pressure will reduce the incidence of DR (page 4). However, many people do not know they have diabetes: the recent Nigeria national blindness and visual impairment survey found that nearly half of all participants with high blood sugar did not know they had diabetes.

Table 1. Expected increase in number of people with diabetes: 2010–2030

	2010		2030		
	Number of people with diabetes	Prevalence of diabetes	Number of people with diabetes	Prevalence of diabetes	Increase in number of people with diabetes
Region	**Millions**	**%**	**Millions**	**%**	**%**
Europe	55.2	6.9	66.2	8.1	20.0
North America and Caribbean	37.4	10.2	53.2	12.1	42.4
Middle East and North Africa	26.6	9.3	51.7	10.8	93.9
South and Central America	18	6.6	29.6	7.8	65.1
Western Pacific (incl. China)	76.7	4.7	112.8	5.7	47.0
Southeast Asia (incl. India)	58.7	7.6	101	9.1	72.1
Sub-Saharan Africa	12.1	3.8	23.9	4.7	98.1
Total (average)	**284.6**	**(6.4)**	**438.4**	**(7.7)**	**54.0**

Courtesy of Zoe Okrim. Data taken from IDF Diabetes Atlas 4th Ed, © International Diabetes Federation 2009

Adan Ovelar/Social Security Central Hospital, Asunciòn

All diabetes patients must have a retinal examination every year. PARAGUAY

Where there are systems in place to manage diabetes and its complications, we must therefore do more to look for people with diabetes and improve their care (page 16). One example would be to do routine urine or blood glucose testing on all patients who present with cataract.

Good control of blood sugar and blood pressure. Even though improving a patient's control of blood sugar and blood pressure may be outside our area of expertise, we can advise our patients about the importance of good control and support them by ensuring that we are working in partnership with physicians and diabetes specialists. We should use every opportunity to reinforce the message that good control in the present will pay off in the future.

Early diagnosis of DR. Where there is treatment available for DR, all health care workers must reinforce the following messages when working with diabetes patients:

- Diabetes can cause blindness
- The early stages are only detectable by examination of the retina
- Everyone with diabetes should have an annual retinal examination to allow early diagnosis and treatment.

If all of us used every contact with every diabetes patient to reinforce these messages, then we can be confident that there would be a reduction in the risk of blindness due to DR.

Referral for treatment. For ophthalmologists and health planners, there is an urgent need to ensure that networks and resources for the referral and treatment of DR are in place. It is impossible and unnecessary to provide a laser in every eye clinic. However, every eye clinic needs to know where to send their patients who need laser treatment. Ophthalmology residency programmes should ensure that their curricula emphasise the conditions that will be the major causes of blindness in the future, such as DR. Although not all ophthalmologists will treat DR, they must all know how to recognise it and when to refer patients for treatment.

Thinking beyond the clinic

One of the challenges in managing DR is that it requires partnerships with many different health care workers – both to find people with diabetes and to provide the eye care they need. We have to forge alliances with physicians, podiatrists, dieticians, pharmacists and all the other health workers and policy makers involved in the care of patients with diabetes. We will depend on them to encourage their patients to have annual eye examinations and we must return the favour by encouraging the patients we see to maintain good control of their diabetes and blood pressure. Every eye health worker can play a part in reaching out to other health workers and building the networks that will be critically important for preventing blindness from DR.

In this issue we have tried to make the complexities of DR relatively simple, so that all eye health workers will have a clearer idea of what DR is and what it looks like. We hope that the relatively simple DR grading system on page 12 will help you to decide who has sight-threatening DR and who has not. We have also tried to give clear guidelines for management, based on the best available evidence (page 5).

There is no single solution to DR that can be applied to every community worldwide. As with VISION 2020, the best results will be achieved by developing programmes at district level that take into account local conditions and resources. We have included some guidelines and a case study of a diabetes programme (page 17), not as a blueprint to be followed in every detail, but to help you to think about how you might achieve the same things in your own district, clinic, or village.

If there is one single message in this issue of the journal, it is this: diabetes and DR are everybody's business. We must not leave it just to the specialists, whether they are specialists in diabetes or in retinal disease. In future, every single health worker will have to contribute to preventing, detecting, and managing diabetes and diabetic retinopathy.

Understanding diabetes and diabetic retinopathy

Blood sugar levels are controlled by insulin, a hormone secreted by cells in the pancreas. In diabetes, this control mechanism breaks down, which leads to high levels of glucose in the blood. Type 1 diabetes is uncommon. It is caused by destruction of the insulin-secreting cells in the pancreas, and at present there is no means of predicting or preventing it. It occurs in young people and begins suddenly. This type of diabetes always requires treatment with injections of insulin.

Type 2 diabetes is much more common. It begins very gradually and may be completely without symptoms. Until recently, it was thought to affect only people over 40 years old, but it is now found in much younger patients, particularly in association with obesity. In most people, type 2 diabetes is related to obesity and may be prevented and often controlled by weight loss and exercise. Not all people with type 2 diabetes will require insulin. Some may be treated with tablets and some may only require weight loss to restore control of blood sugar.

Both type 1 and type 2 diabetes are serious conditions. In both forms, the elevated blood sugar causes complications, most of which are due to damage to small blood vessels. This causes diabetic retinopathy, kidney disease, and foot ulceration – which may lead to amputation. In addition, the high blood sugar increases the risk of blockage of larger blood vessels, leading to strokes and heart attacks.

In **diabetic retinopathy (DR)**, damaged small blood vessels leak in the retina at the back of the eye. Later, the blood vessels become blocked, which leads to the formation of abnormal new blood vessels. These new vessels are fragile and can bleed into the vitreous gel; they can also pull on the retina, causing retinal detachment. If blood vessels become damaged in the central part of the retina, this causes diabetic maculopathy, which is characterised by swelling of the retina (macular oedema).

All of these changes can damage vision permanently, and eventually lead to blindness unless the patient receives treatment (mainly laser treatment). Even then, treatment will only stop or slow down the disease – existing damage to the eye or to the patient's vision cannot be undone.

Everyone with diabetes will develop some degree of DR eventually, most commonly after ten or more years of living with diabetes. High blood sugar and high blood pressure increases the risk of developing DR.

PREVENTION

Why does diabetic retinopathy happen, and how can we stop it?

Zoe Ockrim
Medical Retinal Fellow, Moorfields Eye Hospital, City Road, London, EC1V 9PD

Diabetic retinopathy (DR) is a complication of diabetes. We can prevent DR both by preventing diabetes (primary prevention) and by improving the management of diabetes to slow down the onset, and reduce the severity, of DR (secondary prevention).

Primary prevention

There is little that can be done to prevent type 1 diabetes. Its cause is uncertain and there is no evidence that any intervention can prevent it.

The vast majority of the 300 million people with diabetes have type 2 diabetes, which is often preventable. There is good evidence that lifestyle changes, such as losing weight, increasing physical activity, and eating more fruit and vegetables can lead to a significant reduction in the incidence of type 2 diabetes.

As diabetes is a cause of visual impairment, we should work with existing public health programmes and also ensure that diabetes is included in our eye care programmes. Eye care workers should take every opportunity to reinforce public health messages about avoiding obesity and taking regular exercise, and advise patients about weight loss and diet where possible. In addition, our specialist input might be valuable to the public health campaign, as avoiding blindness could be a powerful motivator for people to change their lifestyle for the better.

Jonathan Walker

A volunteer checks the blood sugar of a patient in an eye clinic. FIJI

Secondary prevention

Optimal blood sugar control

Good blood sugar (glycaemic) control can reduce the risk of retinopathy in anyone with diabetes.

Type 1 diabetes. The Diabetes Control and Complications Trial followed two groups of people with type 1 diabetes, one that was intensively treated to control blood sugar and one that was managed in the usual way. After nine years they found a 26% reduction in the risk of development and progression of DR in the intensively treated group.

Type 2 diabetes. The United Kingdom Prospective Diabetes Study (UKPDS), published in 1997, showed that tight blood sugar control reduced the risk of progression of retinopathy and the need for laser treatment in people with type 2 diabetes. This study showed a 16% reduction in the risk of legal blindness in the intensively treated group compared to usual management at ten years.

> **'Avoiding blindness could be a powerful motivator for people to change their lifestyle for the better'**

In practice, however, perfect blood sugar control is unattainable in patients with type 1 diabetes because of the risk of unpredictable hypoglycaemia. With type 2 diabetes, most patients do not achieve tight control and if they do it tends to deteriorate with time.

Control of blood pressure

In patients with high blood pressure (hypertension), control of blood pressure can reduce the risk of developing DR. The UKPDS randomised hypertensive patients with diabetes to two different groups:

- tight blood pressure control (<150/85 mmHg) using predominantly a beta-blocker or an angiotensin converting enzyme (ACE) inhibitor with the addition of other agents if required
- less tight blood pressure control (<180/105 mmHg) without the use of beta-blockers or ACE inhibitors.

After seven years, there was a 35% reduction in the progression of DR in the tight blood pressure control group. At nine years, the tight blood pressure control group showed a 47% reduction in the risk of moderate visual loss and a 35% reduction in the need for laser treatment. The study found no benefit of the ACE inhibitor (captopril) over the beta-blocker (atenolol).

Several large studies have looked at the effect of individual ACE inhibitors in patients with diabetes. However, the effect on DR has been, at best, a secondary outcome measure and there is no clear evidence that one method of lowering blood pressure is superior to another in terms of its effectiveness in slowing down the progression of DR.

The Diabetic Retinopathy Candesartan Trials (DIRECT) were large randomised trials designed to assess whether reducing blood pressure in diabetic patients who did not have hypertension lowered the incidence/progression of DR. The trials showed that there was no effect on either the incidence or progression of DR.

At present, therapies for established DR reduce the progression of the disease and stabilise visual acuity. Only rarely do these therapies lead to improved vision. Treating DR can be expensive. Every patient also requires monthly follow-up, which greatly increases the number of clinic visits.

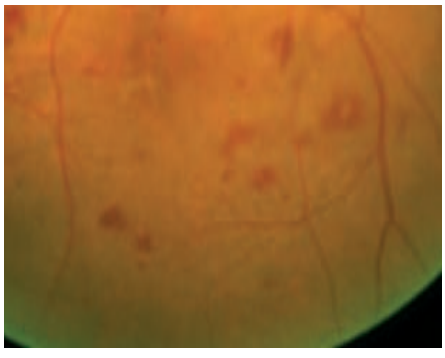
The best and most affordable care we can provide for people with diabetes is secondary prevention to reduce the incidence of DR by means of good control of blood sugar and blood pressure. This can only be achieved if there is collaboration with physicians and good communication between eye health workers and patients. These measures will not only decrease the incidence and progression of DR, but also the other complications of diabetes, and they will be beneficial for every diabetes patient.

Recognising and managing diabetic retinopathy

Anthony Hall
Former Head of Department of Ophthalmology, Kilimanjaro Christian Medical Centre, Tanzania.
Email: abhall@kcco.net

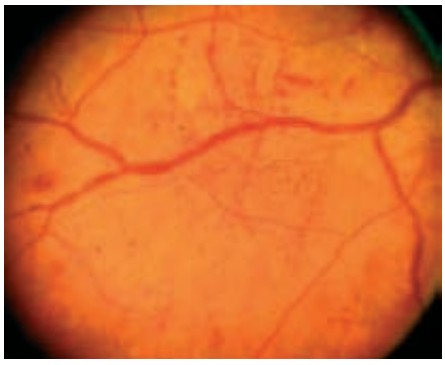
Key learning points

- Detecting and diagnosing diabetic retinopathy is not complicated. There are clinical signs which can be seen with an ophthalmoscope or a slit lamp and 90- or 78-dioptre lens.
- Diabetic retinopathy is treatable. Treatment usually maintains vision, but does not restore vision that has alread y been lost.
- In diabetic maculopathy, laser or anti-VEGF injections are both proven to work. Intravitreal steroid is ineffective in most patients.
- Laser treatment should use small spots and just enough power to produce a visible reaction.
- Proliferative retinopathy is best treated with pan-retinal laser. The commonest error is undertreatment, and laser should be applied until there is regression of the new vessels or there is no room for further treatment.
- Vitrectomy is useful for vitreous haemorrhage and late complications of proliferative retinopathy. Pre-treatment with bevacizumab reduces the risk of surgical complications.



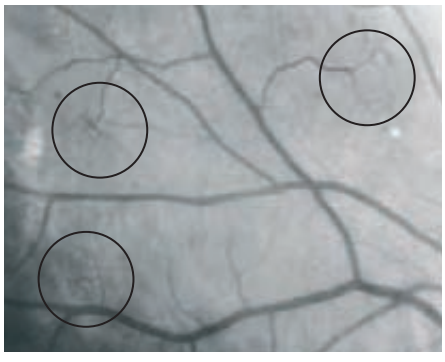
David Yorston

Figure 1. Haemorrhages (larger, uneven red 'blots') and microaneurysms (small, round 'dots')



University of Wisconsin Fundus Photograph Reading Center[a]

Figure 2. Venous beading, i.e., irregular calibre ('thickness') of the veins



University of Wisconsin Fundus Photograph Reading Center[a]

Figure 3. Intraretinal microvascular abnormalities (IRMA). The circles show the odd, twisted shape of IRMA

Recognising DR

The management of diabetic retinopathy (DR) depends on accurately recognising or classifying the different types of DR and knowing what treatment to give the patient.

DR has clinical signs which can be seen with an ophthalmoscope or with a slit lamp and a 90- or 78-dioptre lens. The advantage of the slit lamp is that it allows you to visualise the retina with both eyes. This stereoscopic vision provides a sense of depth which aids diagnosis, particularly of macular oedema. Other aids to DR diagnosis are fundus photography, fluorescein angiography, and optical coherence tomography (see box on page 7).

1 Non-proliferative DR

The clinical signs of **non-proliferative DR** are:

- haemorrhages (Figure 1)
- microaneurysms (Figure 1)
- venous beading (Figure 2)
- intraretinal microvascular abnormalities (IRMA) (Figure 3)

2 Proliferative DR

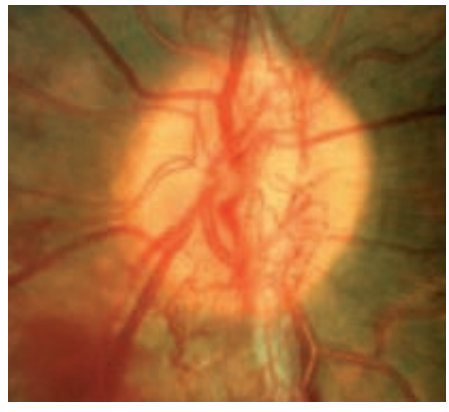
Proliferative DR can exhibit all the same clinical signs as non-proliferative DR. However, the key characteristic of proliferative DR is new vessels growing onto the posterior vitreous surface from the retina or optic disc (Figure 4).

The new vessels damage sight by bleeding (Figure 5) or forming sheets of fibrovascular membranes that may cause traction retinal detachments. Traction retinal detachment occurs when the fibrovascular tissue contracts and pulls the retina away from the underlying choroid. If this affects the macula, the central vision will be lost.

The clinical signs of **proliferative DR** include:

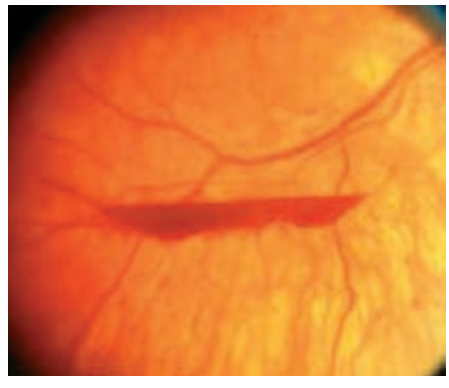
- new vessels growing onto the posterior vitreous surface from the retina or optic disc (Figure 4)
- vitreous and/or pre-retinal haemorrhages (Figure 5)
- fibrosis
- traction retinal detachment.

Continues overleaf ➤



Clare Gilbert

Figure 4. New vessels, the key characteristic of proliferative diabetic retinopathy



University of Wisconsin Fundus Photograph Reading Center[a]

Figure 5. Pre-retinal haemorrhage, one of the signs of proliferative diabetic retinopathy

3 Diabetic maculopathy

Diabetic maculopathy occurs when DR affects the central part of the retina. Blood vessels leak, leading to diabetic **macular oedema** (swelling of the retina).

The early treatment of diabetic retinopathy study (ETDRS) defined clinically significant macular oedema (CSMO)[1] as the stage at which the eye needs to be treated in order to prevent loss of vision. The definition depends on recognising the following:

- retinal thickening and exudates (Figure 6) at or within 500 microns of the fovea (within one third of a disc diameter).
- larger zones of retinal thickening (one disc diameter or more), if within one disc diameter of the fovea.

Retinal thickening can only be observed stereoscopically. So, for practical clinical purposes, look for other easily visible markers for macular oedema such as exudates within a disk diameter of the fovea.

Clare Gilbert

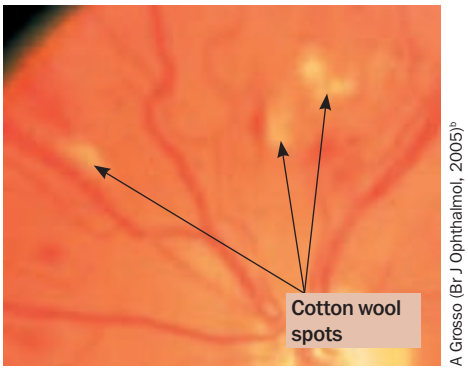
Figure 6. Exudates. This is an example of circinate exudates, which are circular in appearance

The blood vessels in the central part of the retina may also become blocked (capillary closure), leading to **macular ischaemia**. Macular ischaemia occurs when there is insufficient blood supply to the macula. This will impair the normal functioning of the retina, leading to reduced vision.

There is no effective treatment for macular ischaemia,[1] but it is important to recognise it so that you don't waste the patient's time and money with ineffective laser or anti-vascular endothelial growth factor (anti-VEGF) treatment.

Although macular ischaemia can only be diagnosed conclusively by fluorescein angiography (see box on page 7), you should suspect it if the following conditions are met:

- reduced visual acuity
- evidence of retinal ischaemia, e.g. cotton wool spots (Figure 7) or blot haemorrhages
- no macular oedema at the fovea
- no other cause for reduced vision (e.g. cataract, refractive error).



A Grosso (Br J Ophthalmol, 2005)[b]

Figure 7. Cotton wool spots

Treating proliferative diabetic retinopathy

The two main treatment options for proliferative DR are pan-retinal laser photocoagulation and diabetic vitrectomy.

Pan-retinal photocoagulation (PRP)

Pan-retinal photocoagulation (PRP), or scatter laser, is the main form of treatment for proliferative diabetic retinopathy.

The aim of the laser is to induce regression of new blood vessels (that is, to make them stop growing and shrink). It must be given early enough and cover enough retina to induce regression of the vessels that cause the complications of vitreous haemorrhage and tractional detachment of the retina.

A 50% reduction in severe visual loss after PRP was reported by the Diabetic Retinopathy Study for patients with new vessels on the optic disc.[1]

Diabetic vitrectomy

Vitrectomy is indicated in proliferative diabetic retinopathy in the following conditions:

FROM THE FIELD

How I look for diabetic retinopathy: a vision technician's experience

"I am Lalitha Y, and I have been working as a vision technician at LV Prasad Eye Institute since 2008. I hail from a remote rural village in Prakasham District and I joined the vision technician programme at LVPEI in 2007. During this programme, we were trained to look for diabetic retinopathy (DR) by direct ophthalmoscope.

"Whenever someone with diabetes visits my vision centre, I will initially take a detailed history regarding the duration of diabetes, their blood sugar control, medication (drugs/insulin), diet, physical activity, smoking, alcohol intake, family history of diabetes, and other systemic diseases like hypertension, diabetic nephropathy, neuropathy, and so on. I also record any history of blurred vision for distance or near vision, flashes, floaters in the field of view, and any fluctuations in vision.

"After checking the patient's visual acuity, I check for any extra-ocular muscle imbalance by checking eye movements in all directions. During a slit lamp examination (before dilation) I look mainly for neovascularisation of the iris and record intraocular pressure.

"After dilation, I will then examine the posterior segment by direct ophthalmoscope. If the media are clear, I will check for signs of DR, such as haemorrhages or exudates. If the media are not clear or if the patient has signs of DR, I will refer the patient to a secondary centre ophthalmologist for dilated fundus examination, which will give them the information they need to manage the patient's DR. Recently, I was trained to take fundus photographs. This helps me to identify patients with DR, who I would then send to a secondary centre for further management.

'I will initially take a detailed patient history'

"I will then talk to the patient and explain the role of good blood sugar control."

Editor's note: In patients with high blood pressure, good blood pressure control will reduce the likelihood that a patient's DR will get worse (see article on page 4). Eye care workers would do well to check their patients' blood pressure and advise those with high blood pressure on the importance of control, referring them to a physician if they needed help.

- non-clearing vitreous haemorrhage
- pre-retinal (or sub-hyaloid) haemorrhage
- tractional retinal detachment threatening, or involving, the macula
- combined rhegmatogenous/tractional detachment
- progressive severe fibrovascular proliferation in spite of adequate PRP.

Currently, vitrectomy for diabetic macular oedema is reserved for the few patients who have vitreous traction on the macula.[2]

The technique is an important part of the treatment of proliferative diabetic retinopathy and leads to improvement or stabilisation of vision in 90% of patients.[1,2] Vitreous and blood are cut and aspirated and membranes causing tractional detachment of the retina are removed. This may be done by segmenting the membranes or by delamination, i.e. removing the whole of the posterior hyaloid and associated fibrovascular membranes by cutting them off the surface of the retina.

In countries without screening, many people present with long-standing tractional retinal detachments of the macula. The result of diabetic vitrectomy in these eyes is not so good. In a resource-poor environment, those with a better prognosis should be prioritised.

It is worth pre-treating patients with **intravitreal bevacizumab** prior to vitrectomy.[3] A Cochrane review of six randomised controlled trials found that pre-treatment with 1.25 mg of intravitreal bevacizumab resulted in shorter operations with less endodiathermy and intra-operative bleeding. Post-operative reabsorption of blood was significantly shorter. Final best-corrected visual acuity was significantly better.

The effect of intravitreal bevacizumab on neovascularisation is rapid. The first effects can be seen in 24 hours. The optimum time for a preoperative injection would seem to be 5–7 days before the operation.

In a proportion of patients, intravitreal bevacizumab preoperatively may lead to clearing of the vitreous haemorrhage, thus avoiding surgery.

Treating diabetic maculopathy

Diabetic maculopathy is a major cause of vision loss amongst patients with diabetes. Treatment includes steroids, anti-vascular endothelial growth factor (anti-VEGF), and laser.

Steroid treatments

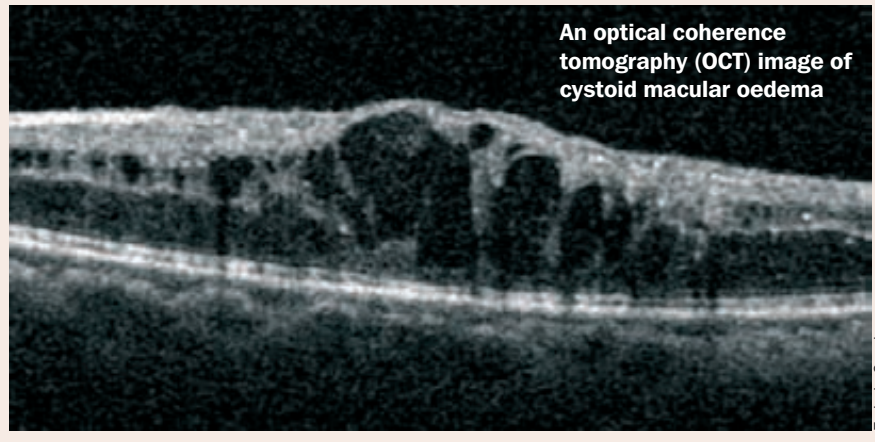
In the Diabetic Retinopathy Clinical Research Network trial, intravitreal injections of the steroid triamcinolone acetonide was compared with standard laser treatment. Although there were short-term improvements in visual acuity with intravitreal triamcinolone acetonide (IVTA), this improvement was not sustained. Laser was more effective and had fewer side effects than IVTA. The side effects of IVTA included cataract formation and raised intraocular pressure. Recently, the same group found that there was one exception. In pseudophakic eyes, IVTA and prompt laser seemed more effective than laser alone.[4]

Anti-vascular endothelial growth factor (anti-VEGF) treatment

VEGF levels are increased in the vitreous and retina in patients with diabetic retinopathy. The most recent anti-VEGF drugs to be evaluated in the

Continues overleaf ➤

Investigating DR: photos, fluorescein angiography and OCT



An optical coherence tomography (OCT) image of cystoid macular oedema

Farieda Cassiem

Diabetic retinopathy (DR) can be diagnosed by clinical examination alone if you are good at examining the retina with a slit lamp microscope. Using the slit lamp, you will be able to detect haemorrhages, new vessels, exudates, and retinal thickening due to oedema. If the diagnosis can be made clinically, are investigations ever necessary?

Photos are probably the most useful investigation. The cost of fundus cameras is still high, but they are becoming more affordable and the quality of pictures is improving all the time. They are also easy to use. The most valuable use of photography is in patients with diabetic maculopathy or new vessels who have laser treatment. Often, the laser leads to a complete cure and the exudates and new vessels disappear. However, sometimes they do not completely resolve. If you only examine the patient occasionally, it is difficult to remember exactly what the retina looked like before you treated it. When you can still see retinopathy months after laser treatment, you may be unsure if it is better, worse, or much the same. If you have photos to refer to, you can be certain of what has changed. Of course, photos are also very useful for detecting DR and counselling patients.

> **'If you have photos to refer to, you can be certain of what has changed'**

Fluorescein angiography is a technique for examining the fine detail of the retinal circulation. It will show the leaks that cause exudative maculopathy and the areas of blocked capillaries that cause ischaemic maculopathy and proliferative retinopathy. However, injections of fluorescein carry a small risk (about 1:20,000) of a severe allergic response, which can be fatal. They should not be given unless there are facilities for resuscitation.

Optical coherence tomography (OCT) is a relatively new technique that uses lasers to scan the retina and build up a very detailed three-dimensional image. This will not only detect any oedema or swelling of the retina, but also measure it and draw a map that shows the areas where the swelling is greatest. It is fast, safe, and does not require any injections. Unfortunately, the machines cost about £50,000! In high-income countries, OCT and photos, in combination, are the usual means of documenting and investigating DR. As cameras and OCT machines become more affordable, they will also become more widely used in low- and middle income countries.

treatment of diabetic maculopathy are ranibizumab[2] (Lucentis) and bevacizumab[5] (Avastin). These trials showed a benefit with intravitreal ranibizumab and bevacizumab in patients with foveal thickening. However, intravitreal ranibizumab injections cost around US $1,200 each and the patients in this study received eight or nine injections in the first year (a cost of around US $10,000 per patient per year.) Intravitreal bevacizumab is much cheaper. We are able to offer patients an intravitreal bevacizumab injection for as little as US $25.

In practice, laser should remain the cornerstone of treating clinically significant macular oedema and the use of intravitreal injections should be tailored to the needs of individual patients.

Laser

The Early Treatment of Diabetic Retinopathy study compared macular laser with observation. There was a 50% reduction in moderate visual loss in the group that received laser (from 24% to 12%).

The recommended protocol is as follows:

- Treat circinate exudates (Figure 6) with focal laser, blanching the retina in the inferior retina first as new blood falls down and blocks the view inferiorly.

Managing diabetic retinopathy in Africa

Case study

In our clinic, a typical patient, Mrs X, was first seen with a visual acuity of 6/9, a few macular exudates, and proliferative disease. The treatment plan followed the textbook recommendation of doing focal laser for the maculopathy first. The patient then missed two appointments and pan-retinal photocoagulation (PRP) was delayed by about two months. When PRP was finally given, the intention was to give it in the recommended multiple sessions. However, due to further missed appointments, the interval between laser sessions was over a month. This allowed fibrovascular proliferation to continue. It was six months from the time of presentation before laser was completed. By then, tractional retinal detachment involving the macula had developed and vitrectomy was required. Mrs X's final visual acuity was counting fingers at three metres.

What are the lessons to be learned from this? How can we do better?

We audited a number of patients who had ultimately needed vitrectomy for advanced proliferative disease to find out how we could improve, and arrived at the following recommendations for laser in countries where patients may not come for regular appointments.

Anthony Hall

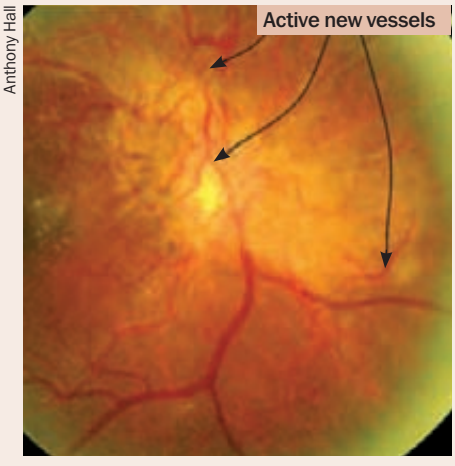


Figure 8. Eye before treatment. The arrows at the top point out active new vessels

Anthony Hall

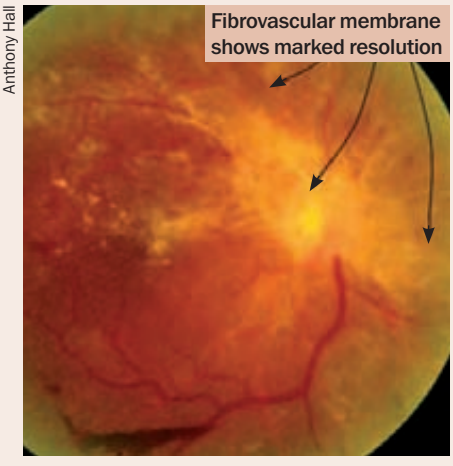


Figure 9. Ten days after PRP. Note regression of new vessels

Recommendations

1. **Warn all diabetes patients to come if they experience floaters or blur**, as these symptoms suggest a vitreous haemorrhage.
2. **Give PRP to anyone who has vitreous or sub-hyaloid blood** (Figure 5) even if there are no visible new vessels. Treat any size area of definite neovascularisation, on the disc or elsewhere. Treat any eye that has evidence of fibrosis, as this is evidence of proliferative disease.
3. **Treat patients faster**. Regression of new vessels should be seen after a week or two. (Figures 8 and 9). If patients come from far away, consider admitting them to complete the laser before they are discharged. Attempt to complete the laser in one week, instead of several weeks. Treat the inferior retina first as new blood falls down and blocks the view inferiorly.
4. **Make the most of each session you have**. It is worth treating some patients in one session. This is particularly important if there are large neovascular (NV) formations which have an increased risk of bleeding, or if the patient is unlikely to return. Remember to avoid application of intense burns which are unnecessary to induce regression. A pan-retinal pattern of excessively intense burns can lead to choroidal effusion and angle-closure glaucoma with blindness. Treat one burn width apart, as shown in Figure 10. Oedema surrounding the burns makes them look more confluent than they are.
5. **Repeat treatment**. All neovascularisation should regress in two to four weeks. If it has not regressed, treat again. If bleeding occurs after laser, re-treat until NV formations have gone or maximal treatment has been given. Consider treating inside the arcades, particularly temporally.

Anthony Hall

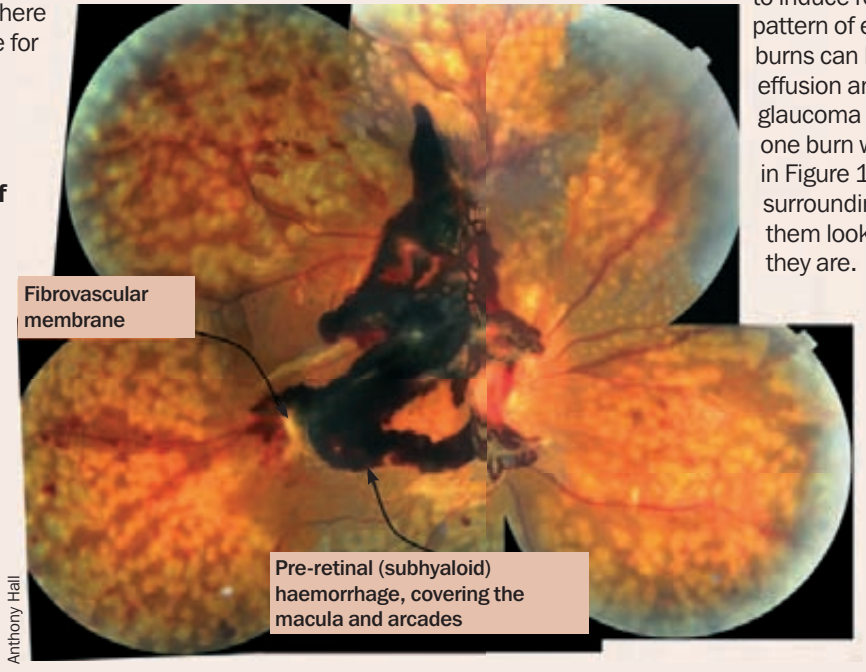


Figure 10. Pan-retinal photocoagulation

centre of the exudate. It is not necessary to target individual microaneurysms.
- Diffuse macular oedema is treated by a grid laser in the area of thickening. Burns should be one burn width apart, using a spot size of 75 to 125 microns, duration 20–50 milliseconds. Do not use the repeat mode.
- Start with a low power setting, around 150 milliwatt, and increase the power until the desired endpoint is reached. Aim to produce a grey to cream change in colour. White means the laser is too hot and the power should be reduced.
- Take care not to encroach on the foveal avascular zone. It is wise to avoid treating perifoveal microaneurysms as this is likely to increase perifoveal capillary dropout (consider intravitreal bevacizumab instead). The chorioretinal atrophy caused by burns, especially intense burns, within 300 to 500 microns of the fovea can years later extend into the fovea and cause vision loss, particularly in myopes.
- In patients with established foveal thickening or who are not responding to laser, consider intravitreal bevacizumab. In pseudophakic eyes, consider IVTA but watch the intraocular pressure closely.

Populations in low- and middle-income countries face a huge burden of blinding DR. Urgent advocacy is needed for governments to initiate programmes to address this. In the interim, every residency programme must provide training in the skills needed to manage DR, including interpreting investigations and delivering laser and other treatments. Refresher courses can be arranged for those not adequately trained or who have been without the necessary equipment for some time. We must also advocate for lasers and other necessary equipment wherever there is a trained ophthalmologist.

References

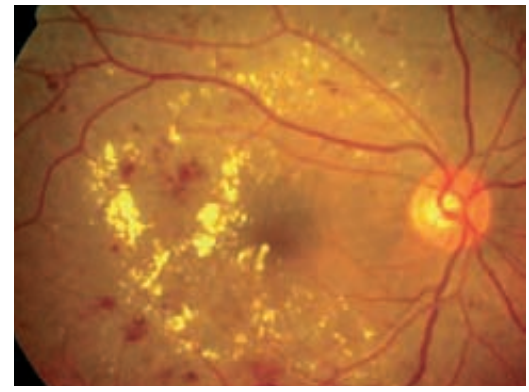
1 Ockrim Z, Yorston D. Managing diabetic retinopathy. British Med J 2010;341:c5400.
2 Yorston D, Wickham L, Benson S, Bunce C, Sheard R, Charteris D. Predictive clinical features and outcomes of vitrectomy for proliferative diabetic retinopathy. Br J Ophthalmol 2008;92:365-8.
3 Ahmadieh H, Shoeibi N, Entezari M, Monshizadeh R. Intravitreal bevacizumab for prevention of early postvitrectomy hemorrhage in diabetic patients: a randomized clinical trial. Ophthalmology 2009;116:1943-8.
4 Elman MJ, Aiello LP, Beck RW, Bressler NM, Bressler SB, Edwards AR, et al. Randomized trial evaluating ranibizumab plus prompt or deferred laser or triamcinolone plus prompt laser for diabetic macular edema. Ophthalmology 2010;117:1064-77.
5 Soheilian M, Ramezani A, Obudi A, Bijanzadeh B, Salehipour M, Yaseri M, et al. Randomized trial of intravitreal bevacizumab alone or combined with triamcinolone versus macular photocoagulation in diabetic macular edema. Ophthalmology 2009;116:1142-50.

Photographs

a Reproduced with permission, University of Wisconsin Fundus Photograph Reading Center, Madison, WI. http://eyephoto.ophth.wisc.edu
b Grosso A, Veglio F, Porta M, Grignolo FM, Wong TY. Hypertensive retinopathy revisited: some answers, more questions. Br J Ophthalmol 2005;89:1646-1654.

Cataract and diabetic retinopathy

James Rice
Vitreoretinal consultant, University of Cape Town, Division of Ophthalmology, Faculty of Health Sciences, H53 Old Main Building, Groote Schuur Hospital, Observatory 7925, South Africa.
Email: **james.rice@uct.ac.za**



Courtesy of K Suttle

Consider intravitreal triamcinolone or anti-VEGF at the end of surgery to reduce macular oedema

When managing the cataract of a patient with diabetes, you should remember that cataract surgery may make diabetic retinopathy worse. Eyes with mild to moderate non-proliferative diabetic retinopathy at the time of surgery are considered less at risk. Those with severe non-proliferative and proliferative diabetic retinopathy have a higher risk of progressive disease.[1] Clinically significant macular oedema (CSMO) present at the time of surgery is likely to progress and eyes with previously treated CSMO are at increased risk of recurrence. The risk of progression is increased if the operation is complicated by excessive manipulation, vitreous loss, or severe post-operative inflammation.

Ideally, when the cataract does not preclude laser treatment, you should achieve and maintain effective control of retinopathy and maculopathy for at least three months before surgery.

The severity of the cataract sometimes prevents adequate examination or treatment of the retina in patients with diagnosed or suspected severe non-proliferative and proliferative diabetic retinopathy. In this case, you should deliver pan-retinal photocoagulation either during the procedure or in the early post-operative period. When performing intraoperative pan-retinal photocoagulation with an indirect ophthalmoscope, you should fill the anterior chamber with viscoelastic and place a corneal suture. Complete the pan-retinal photocoagulation before inserting the intraocular lens. This will provide a stable anterior chamber and optimal view, particularly if you anticipate indentation of the periphery.

If you plan to give laser treatment with a contact lens in the early post-operative period, then you should suture the cataract wound. If it is still considered hazardous to use a contact lens then effective slit lamp laser can still be applied through a non-contact 78D or 90D lens. You can also use indirect laser for pan-retinal photocoagulation.

If the patient has diabetic maculopathy and/or more advanced retinopathy, consider intravitreal triamcinolone or anti-VEGF at the end of the procedure to reduce macular oedema. Triamcinolone targets the inflammation that exacerbates the oedema. Anti-VEGFs also reduce retinal swelling and may improve visual outcomes.[2] Intravitreal steroids may cause raised intraocular pressure and anti-VEGF agents increase the risk of tractional complications in eyes with fibrovascular proliferation. You should still apply macular laser for CSMO post-operatively.

‘You should remember that cataract surgery may make diabetic retinopathy worse’

In diabetes patients, it is very important to minimise post-operative inflammation. You should use post-operative topical non-steroidal anti-inflammatory drugs in addition to routine topical steroid preparations, particularly in those with pre-existing macular oedema.[3]

In summary, diabetes patients with mild to moderate diabetic retinopathy and no maculopathy have a good prognosis following cataract surgery. You should treat more advanced retinopathy or maculopathy at least three months prior to surgery if possible. Whereas laser is the most recognised form of treatment, pharmacological agents play an important role in the management of these patients. It is also important to monitor high-risk patients in the post-operative period.

References

1 Somaiya MD, Burns JD, Mintz R, Warren RE, Uchida T, Godley BF. Factors affecting visual outcomes after small-incision phacoemulsification in diabetic patients. J Cataract Refract Surg 2002;28(8):1364-1371.
2 Cheema RA, Al-Mubarak M, Amin YM, Cheema MA. Role of combined cataract surgery and intravitreal bevacizumab injection in preventing progression of diabetic retinopathy: prospective randomized study. J Cataract Refract Surg 2009;35(1):18-25.
3 Endo N, Kato S, Haruyama K, Shoji M, Kitano S. Efficacy of bromfenac sodium ophthalmic solution in preventing cystoid macular oedema after cataract surgery in patients with diabetes. Acta Ophthalmol 2010;88(8):896-900.

I wish someone had told me …

Karinya Lewis
Registrar, Royal Bournemouth Hospital Eye Unit, Castle Lane East, Bournemouth, Dorset BH7 7DW, UK

Key learning points

- The greatest risk factor for loss of vision due to diabetic retinopathy is failure to attend for retinal screening or treatment.
- Many people with diabetes are not aware that diabetes may affect their eyes and may not understand why screening and early treatment are required.
- Education of diabetes patients is the responsibility of everyone involved in their care – don't assume someone else will do it.
- When providing laser treatment, be sympathetic and explain that it may be painful, but that you will take the utmost care to make the patient as comfortable as possible.
- Everyone with dibetes should be taught the 'Things every diabetes patient should know' (see box).

Regular retinal examinations are essential for identifying diabetic retinopathy and applying timely laser treatment before significant vision is lost. This is known as retinal screening and is a key part of the care of all diabetes patients. However, non-attendance at eye clinic for screening has been recognised as an independent risk factor for poor visual outcome from diabetic retinopathy.[1]

In 2005, we undertook a qualitative study involving focus groups and interviews in a rural and urban area to identify some of the reasons why patients fail to attend for diabetic eye examinations.[2] Although our study was conducted in the United Kingdom (UK), many of the findings will be very relevant to people with diabetes wherever they live. Because the UK provides free health care for all citizens, the cost of treatment was not a barrier in this study, but it is likely to be a major barrier where patients have to pay for an eye examination and for laser treatment.

We categorised the barriers into three main areas:

- Patient beliefs
- Social attitudes
- Enabling and disabling factors.

Patient beliefs

Even though most UK patients knew that diabetes could affect their eyes, many were not aware that it could lead to severe visual impairment and blindness. In part, this was because health workers were very reluctant to use the word 'blindness.' In addition, patients did not realise that they would only experience symptoms once DR had become very advanced, and that treatment would be most effective if given before there were symptoms. Some patients with type 2 diabetes thought that it was 'less severe' than type 1 diabetes, and that they were therefore unlikely to experience problems with their vision. As a result, they thought screening was unnecessary.

Patients' expectations of laser treatment were high and they hoped that their vision would improve. They were therefore often disappointed in the outcomes; this led to loss of confidence in the health services and, later, non-attendance. Laser treatment was frequently described as both painful and frightening for patients. Doctors were perceived as unsympathetic, which also made patients less likely to return.

Patients who failed to attend reported that they were afraid of finding out how bad their retinopathy was. Some patients were aware that progression of retinopathy was linked to poor blood sugar control. However, many did not understand that it is inevitable to develop some retinopathy after having diabetes for twenty years, no matter how well it is controlled. When these patients were referred to the eye clinic, they felt that this was because they had failed to control their diabetes, giving rise to feelings of guilt and low self-esteem.

Social attitudes

Hospitals were seen as places for the sick, so for patients who seemed well, hospital attendance for regular retinal screening was not seen as 'normal behaviour.' Whilst most employers seemed to be willing to give time off for occasional appointments, time off for regular appointments was not tolerated. Patients felt that, ultimately, it would cost them their jobs.

Patients with diabetes have multiple hospital appointments, most of which are for routine surveillance, and some patients chose to attend only the appointments they saw as essential. Often, this meant they did not attend for retinal screening.

Those patients with poor family support, or whose relatives had a limited understanding of the disease, were less likely to attend for eye examinations, as this was not a priority for the family as a whole.

Enabling and disabling factors

In the rural area, transport to and from the clinic was a major barrier as there is poor public transport. Patients with their own vehicles were not permitted to drive due to the dilating eye drops. In the urban area, this was less of an issue as patients were willing and able to use public transport.

Clinic waiting times were identified as a barrier by both patients and providers. Patients said that the delays made them reluctant to ask questions of the doctor to help them better understand their DR. It also made it difficult for friends or relatives to accompany patients or provide transport.

Things every diabetes patient should know

- Diabetes will eventually affect the blood vessels in your eyes. This is called diabetic retinopathy, and it can lead to visual impairment and blindness.
- By controlling your blood sugar and blood pressure, you can reduce the damage diabetes can cause in your eyes. However, your eyes will eventually develop some diabetic changes. If you do get diabetic retinopathy, it is not your fault.
- Diabetic retinopathy in most people has no symptoms – you cannot tell if you have it. Only an examination of the back of your eyes can find it, and you should be examined every year.
- Diabetic retinopathy is treatable if it is found in the early stages. If you attend all your screening or clinic appointments, and have treatment when recommended, it is very unlikely that you will go blind.
- If you do not attend diabetic eye screening or eye clinic appointments, your diabetic retinopathy can become very advanced and will affect your vision. If left untreated, you may go blind.
- Modern treatments with laser and drugs are very effective in stopping vision loss. However, treatment cannot restore vision that has already been lost.

Adan Ovelar/Social Security Central Hospital Asunciòn

Global perspectives

Our study found that the commonest barrier was a lack of awareness about diabetic eye disease and its treatment; this is consistent with other studies. As retinal screening programmes have become more common in low- and middle-income countries, preliminary research[3] from China, Zambia, Qatar, and Paraguay have all consistently shown that, fundamentally, a lack awareness of the severity of diabetic eye disease and a need for preventive treatment before symptoms develop are the main reasons why patients do not access eye care services.

- The study in Zambia, where diabetic eye care was just being established, showed that most patients knew nothing about eye complications as a result of diabetes. They were struggling with much more basic issues such as how to monitor blood sugar.
- The study in China found that a quarter of patients presented for the first time with advanced diabetic retinopathy, and the only variable independently associated with late presentation was lower education level.
- In Paraguay and Pakistan, where programmes have existed for longer, lack of awareness still remained the primary barrier but was closely followed by difficulty in accessing services, more so in rural areas than urban areas.
- Research carried out in Qatar, an Arabic state, highlighted how social attitudes to women can lead to different barriers in accessing eye care services. For men, the barriers were 'too busy' and 'no appointments'; for women, they were 'too great a distance to travel alone' or 'lack of transport'.

The next most commonly reported barrier is the cost of consultation and laser treatment,[4] which will always be an issue where screening and treatment are not subsidised.

Tackling the different barriers

Patient beliefs

It appears that personal beliefs and attitudes to diabetic eye disease are similar across the world and are best tackled through appropriately educating the patient. Eye care providers must play a key role in teaching patients about diabetic eye disease (see opposite). Do not assume that other health providers will have done so. Information about diabetic eye disease, screening, and treatment needs to be accurate, informative, and yet non-intimidating. It is often better received if it is tailored to the individual. Patients seem to benefit from seeing the changes in their own retinal images, where this is possible.

Social attitudes

In areas where social and cultural beliefs about diabetes or eye care services are detrimental to health seeking behaviour, mass media or marketing campaigns may be the best strategy. Patients are most influenced by their family, so including family members in teaching sessions, consultations, and decisions is key to changing patients' behaviour.

Enabling and disabling factors

The purpose of retinal screening is to prevent loss of vision, particularly for those people who are less likely to seek out health services. Screening services therefore need to be made as accessible as possible. Common barriers for health professionals to address may include: patient transport, clinic delays, limited and inconvenient timing of appointments, insufficient notice or publicity, intimidating health staff, and painful laser treatment.

Patients will not attend diabetic eye care programmes if they don't understand why it is important and when it is appropriate. As health care providers we have to ensure that correct information about DR and its treatment is communicated effectively to the patient and their family. If patients come for screening, we must make the patient's experience as convenient, efficient, helpful, and painless as possible to ensure that they return regularly. These barriers are possible to overcome and are sight saving.

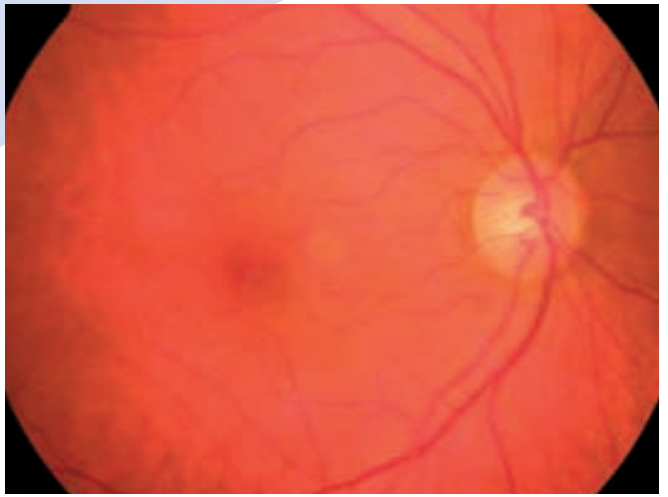
References

1 Rhatigan MC, Leese GP, Ellis J, et al. Blindness in patients with diabetes who have been screened for eye disease. Eye 1999;13:166-9.
2 Lewis K, Patel D, Yorston D, et al. A qualitative study in the United Kingdom of factors influencing attendance by patients with diabetes at ophthalmic outpatient clinics. Ophthal Epidemiol 2007;14(6):375-380.
3 Dissertations (MSc), London School of Hygiene and Tropical Medicine (unpublished). Visit **www.iceh.org.uk/display/WEB/Past+MSc+dissertations**
- Cano M. 2006. Prevalence of diabetic retinopathy and barriers to uptake of eye care services by diabetics at the Central Hospital of the Social Security Institute (IPS) in Asuncion, Paraguay.
- Shaikh A. 2006. Diabetic retinopathy – analysing the Pakistan survey and evaluating local resources.
- Yuan Z. 2007. Risk factors and barriers to eye care services among presenting late diabetic retinopathy patients in Shanxi province in China.
- Chisi S. 2008. Screening for visual impairment and diabetic retinopathy amongst diabetics in the diabetes association in Petauke district in Zambia.
- Al-Malki B. 2009. Barriers preventing diabetic patients from attending diabetic retinopathy screening at primary eye care clinics at primary health care in the state of Qatar.

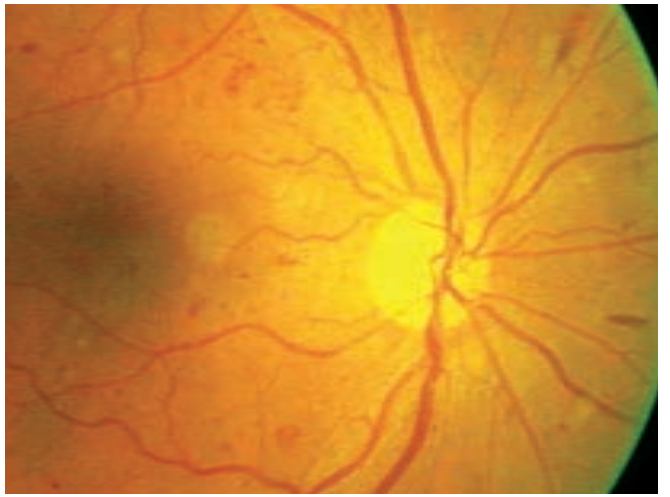
4 Roy MS. Eye care in African Americans with type 1 diabetes: the New Jersey 725. Ophthalmology 2004;111:914-20.

Diabetic retinopathy (DR): management and referral

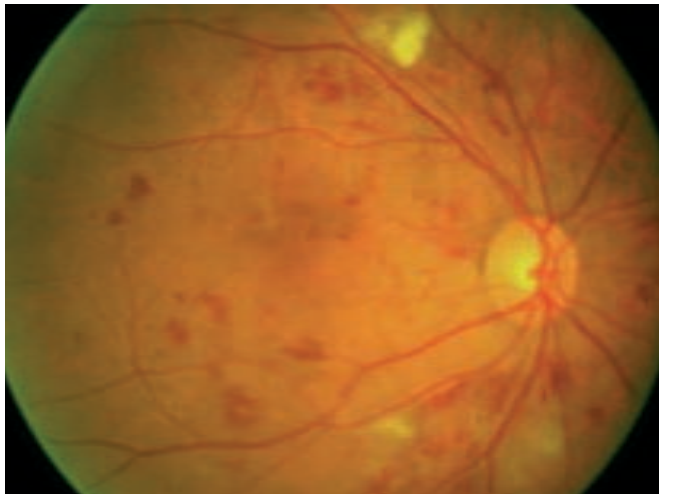
This diabetic retinopathy (DR) grading system is based on the International Council of Ophthalmology's diabetic retinopathy and diabetic macular oedema disease severity scales (see Useful Resources on page 19). At whatever level you work, you must **encourage everyone with diabetes to manage their blood sugar and blood pressure**. Refer them to available services for help if they are not sure how to do this, or if their control is poor.



No abnormalities



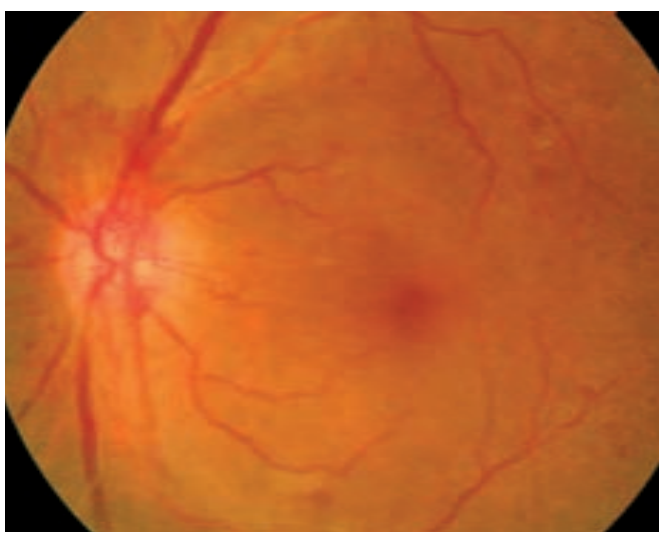
Microaneurysms (small, round 'dots') and haemorrhages (larger, uneven 'blots'). An example of moderate non-proliferative DR



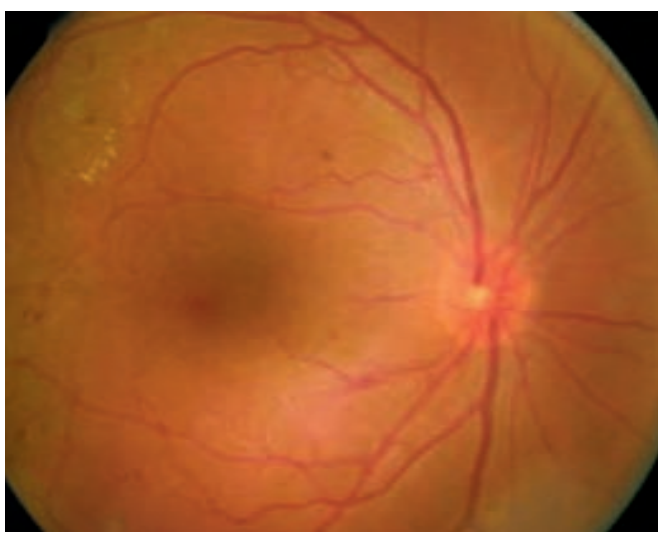
Cotton wool spots (white), haemorrhages, and microaneurysms. An example of severe non-proliferative DR

Diabetic retinopathy stage	Clinical signs	What to do (screening/primary eye care)	What to do (retinal clinic)	What you could say to your patients
No diabetic retinopathy	No abnormalities	Encourage patient to come again in 12 months	Review in 12 months	Diabetes can affect the inside of your eyes at any time. It is important that you come back in twelve months so we can examine you again. This will help to prevent you losing vision or going blind.
Mild non-proliferative diabetic retinopathy	Microaneurysms only	Encourage patient to come again in 12 months	Review in 12 months	Your diabetes is affecting your eyes. At the moment your vision is good, but we must check your eyes in 12 months' time to see if these changes are getting worse. If the damage becomes severe, we will need to treat your eyes to stop the diabetes affecting your sight.
Moderate non-proliferative diabetic retinopathy	More than just micro-aneurysms but less than severe non-proliferative retinopathy	Encourage patient to come again in 6-12 months	Review in 6–12 months	Your diabetes is damaging your eyes. At the moment your vision is good, but we must check your eyes in six months' time as it is likely that these changes will get worse. If the damage becomes severe, we will need to treat your eyes to stop the diabetes affecting your sight. Unless you are treated promptly, you risk losing vision or going blind.
Severe non-proliferative diabetic retinopathy	More than 20 haemorrhages in each quadrant; or venous beading in two quadrants; or intraretinal microvascular abnormalities (IRMA)	Refer to retinal clinic. All patients with severe non-proliferative DR should be in the care of an ophthalmologist. The patient should be re-examined every six months	Either review in 6 months, or consider pan-retinal laser, if follow-up unreliable	Your diabetes has damaged your eyes quite severely, although your vision is still good. You are likely to need treatment soon to ensure that you don't lose vision or go blind. We must check your eyes in six months' time. However, if you think you may not be able to come then, we may treat your eyes now, so we can be sure you don't lose vision later.

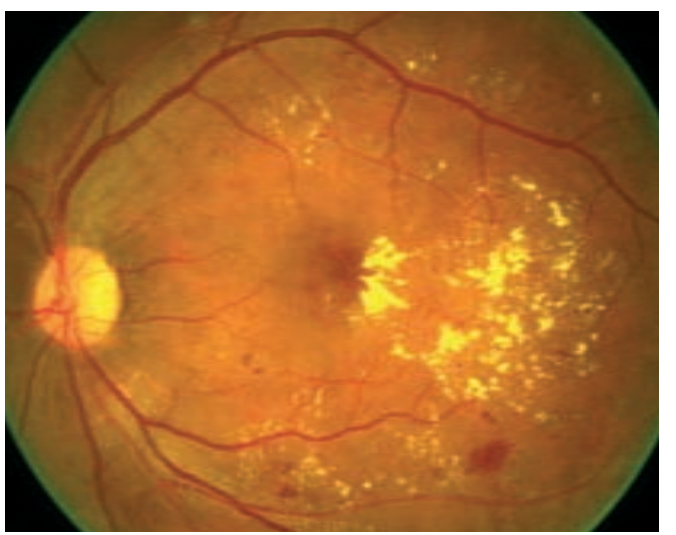
Proliferative diabetic retinopathy	Any new vessels at the disc or elsewhere, vitreous/ pre-retinal haemorrhage	Urgent referral to retinal clinic	Pan-retinal laser / vitrectomy if vitreous haemorrhage or retinal detachment	Your diabetes has damaged your eyes very severely. Although your vision may be good, you are at great risk of losing your sight over the next year. You need urgent treatment to save your sight. Treatment will not improve your eyesight, but should preserve the vision you have.
Macular oedema				
Macular oedema absent	No exudates or retinal thickening in posterior pole	Review in 12 months	Review in 12 months	As for "No diabetic retinopathy" above.
Mild macular oedema	Exudates or retinal thickening at posterior pole, >1dd from fovea	Review in 6 months	Review in 6 months	Your diabetes is damaging your eyes. At the moment your vision is good, but we must check your eyes in six months' time as it is likely that these changes will get worse. If the damage becomes severe, we will need to treat your eyes to stop the diabetes affecting your sight. Unless you are treated promptly, you risk losing vision or going blind.
Moderate macular oedema	Exudates or retinal thickening at posterior pole, 1dd or less from fovea, but not affecting fovea	Refer to retinal clinic. Encourage patient to manage their blood sugar and blood pressure, and refer them to available services for help if they are not sure how to do this	Laser treatment if clinically significant macular oedema (CSMO) Review in 6 months if no CSMO	Your diabetes has damaged your eyes severely. Although your vision may be good at present, it is likely to get worse over the next year or two. You need laser treatment to stop your sight deteriorating. The treatment will not improve your eyesight, but should preserve the vision you have.
Severe macular oedema	Exudates or retinal thickening affecting centre of fovea	Refer to retinal clinic	Laser treatment or intravitreal injections of anti-VEGF drugs	You have probably noticed your eyesight has got worse. This is because your diabetes has damaged your eyes very severely. You need urgent treatment to prevent further loss of vision. The treatment may not improve your eyesight, but if you are not treated, your vision will get worse and you may even become blind.
If you cannot see the retina due to cataract or vitreous haemorrhage, refer to an ophthalmologist for cataract surgery or a retinal sugeon for vitrectomy.				



New vessels on the optic disc. An example of proliferative DR



Exudates (bright yellow). An example of mild macular oedema



Exudates. An example of severe macular oedema

Planning diabetic retinopathy services – lessons from Latin America

Fernando Barría von-Bischhoffshausen
Chair, Prevention of Blindness Committee, Pan-American Association of Ophthalmology (PAAO).

Francisco Martinez Castro
Chair, Subcommittee on Diabetic Retinopathy, VISION 2020 Latin America.

Pedro Gomez-Bastar
CBM Medical Adviser and Chairman, Instituto de la Vision, Universidad de Montemorelos, Cabrera Num. 206, Colonia del Maestro, Montemorelos, NL Mexico, CP 67510.

Key learning points

- A diabetic retinopathy (DR) programme involves more than finding patients at risk of DR. There must be agreed guidelines on who should be examined, referred, or treated. An accurate register of patients with diabetes is essential, and may be difficult to develop.
- Retinal examination methods should be accurate, cost-effective, and cause minimal inconvenience for the patient. Both retinal photography and retinal examination by an ophthalmologist are accurate, but photography may be more cost-effective in the long-term.
- A referral network is essential so that any patient with diabetes found to have severe retinopathy is guaranteed to receive laser treatment if required.
- Ophthalmologists should work closely with physicians and others to ensure that all patients receive appropriate eye care, and diabetes management, to prevent blindness.

The World Health Organization encourages the promotion and development of programmes for the prevention, detection, and management of diabetic retinopathy (DR). Such programmes must identify effective strategies and technology so that they can be adapted to the situation in each part of the world. Programmes must also be monitored and continuously improved.

The guidelines discussed in this article were developed by experts brought together during workshops hosted by the VISION 2020 Latin America technical subcommittee on DR and technical support was provided by the Pan-American Association of Ophthalmology (PAAO). Although these guidelines have been developed for Latin America, we hope that the principles they contain will provide a good starting point for the planning of DR services in other low- and middle-income countries.

Getting started

Before we start planning a DR programme, it is helpful to review where we are and where we want to be:

- What is the need for DR services (for prevention, diagnosis and treatment) in our population?
- What services and resources are required to meet this need?
- What services and resources are already available, and where do these fall short of the need?

Doing so will allow us to set goals and establish priorities for action.

A programme to manage DR should include the following:

- A good understanding of the current and projected **prevalence of DR**, to make it possible to plan services for prevention, screening, and treatment
- **Clinical guidelines** with a simple classification system, recommended examination intervals, and suggestions for treatment
- A way of **finding patients with diabetes and DR**
- **Retinal examination methods** that take into account available equipment and human resources
- Creation or identification of **laser treatment centres** for timely treatment
- An **education and prevention programme** that reaches the whole population
- **Advocacy** to secure the support of the authorities, educators, general practitioners, endocrinologists, and so on
- **Long-term sustainability**, using cost recovery or subsidies (see article on page 17 for an example from India).

Estimating prevalence

The prevalence of DR can be difficult to estimate, and few estimates have been made in low- and middle-income countries. A survey methodology called RAAB+DR has been developed to estimate the prevalence of DR in a population in a quick and affordable way. RAAB+DR has been tested in Mexico, South Africa, and Saudi Arabia, and the results and recommendations will be discussed in a future issue of this journal.

The prevalence of DR in Latin America was estimated in 1999. At the initiative of the Pan-American Association of Ophthalmology, 7,715 patients with diabetes from 16 countries were assessed. The study found that 40.2% showed some degree of DR, that 17% needed treatment, and that, most worryingly, 35% had never before been examined by an ophthalmologist. A recent population-based study in Mexico found that the prevalence of diabetes in people aged 50 or over was 21%. A total of 39% of patients with diabetes had some DR, 16% had diabetic maculopathy, and 8.6% had proliferative DR. Less than half of those known to have diabetes had been advised to have an annual eye examination.

Developing clinical guidelines

It is important to have a simple, easy-to-use grading or classification system to help standardise appropriate management, referral, treatment, and monitoring for patients with diabetes. On page 12 of this issue, we have published one such system, based on the international clinical disease severity scale for DR and diabetic macular oedema as set out by the International Council of Ophthalmology (see Useful Resources on page 23).

Finding patients with diabetes and DR

Ideally, there should be an effective information system that identifies people with diabetes, calls them for screening, and records the outcomes of eye examinations

Pedro Gómez Bastar

When examining people with diabetes, test their visual acuity before you examine their retinas. MEXICO

Pedro Gómez Bastar

Examining a patient's retina. MEXICO

and/or referrals. In Latin America, because of its many fragmented health care systems, identifying patients with diabetes for a national or regional screening programme poses a difficult challenge.

Any screening programme requires clear referral criteria; only patients with retinopathy meeting a pre-defined threshold should be referred to ophthalmologists. In addition, there has to be some quality control to ensure that the screening programme is effective. In areas where services are available, all patients diagnosed as having diabetes should be examined. If that is not possible, we should consider concentrating on high-risk groups, with priority given to people with type 1 diabetes, people aged 50 or over, those with type 2 diabetes of more than ten years' duration, pregnant women with gestational diabetes, and patients with nephropathy (which can be detected by testing for the presence of albumen in the urine).

'Retinal examination methods should be accurate, cost-effective, and cause minimal inconvenience for the patient'

Retinal examinations

Yearly retinal examinations of all diabetes patients are necessary because the condition is asymptomatic in its early stages, and because early treatment reduces both the risk of blindness and the cost of treatment. Methods of detection include the following:

1 **Retinal examination with a slit lamp and hand-held lens following pupil dilation.** This is the method with the greatest specificity (it does not tend to wrongly classify someone who in fact does not have DR as having DR) and sensitivity (it does not tend to miss DR in someone who in fact has it). However, it is time-consuming and hence costly.

2 **Taking one or two photographs of each eye with a non-mydriatic camera.** This achieves good sensitivity and specificity. Retinal photography with a digital fundus camera is rapid and sensitive. Although the camera is expensive, it may reduce costs as only patients with positive findings are referred to ophthalmologists. The photographs can be taken by technicians, allowing ophthalmologists to examine the photographs of large numbers of patients in a short time.

3 **Using a direct or indirect ophthalmoscope.** This has less sensitivity but is useful when you do not have a slit lamp and lens.

Treatment

DR requires **early treatment** to slow or stop the progression of the disease. Improved control of diabetes (page 4) is the most important, especially in patients with diabetic macular oedema. Patients who have established sight-threatening retinopathy will require laser treatment. Steroids and intravitreal anti-vasculuar endothelial growth factor (anti-VEGF) therapy are used together with laser therapy for macular oedema. Vitrectomy is indicated for non-clearing vitreous haemorrhage and tractional retinal detachment.

A workable DR programme must have the facilities, equipment, consumables, medicines, and staff to provide all of the above.

Education and prevention

Education is a priority for the prevention of blindness due to diabetic retinopathy. There must be clear messages for people with diabetes, their families, health workers, and the general public, along the following lines:

- DR is asymptomatic (it has no symptoms), and it carries a real risk of blindness.
- With annual examination of the retina, early detection, and prompt laser treatment, sight can normally be preserved.
- Strict control of diabetes and blood pressure reduces the risk of retinopathy.

At the primary care level, education should focus on lifestyle and prevention of diabetes by diet and exercise. At the secondary level, education should encourage better self-care by patients, including improved control of blood sugar and blood pressure (see article on page 4). Education should also promote regular eye examinations for all people with diabetes.

Continues overleaf ➤

Planning and advocacy

Effective lobbying or advocacy is essential. Advocacy is the act of arguing on behalf of a particular cause, such as establishing a new DR programme, with the aim to influence decision makers to support this cause. When planning an eye care programme, you should aim to develop a solution that is appropriate to the local situation and that is directed at the population with the greatest needs. Aim to ensure the greatest possible coverage, quality of care, and sustainability in the long term.

Political will is needed in order to implement eye health policies, and this can be generated by effective advocacy. Ideally, the eye care programme should be developed by a working group in which everyone involved in the project is represented. This group can identify any decision makers whose support will be required and invite them to participate. The earlier the decision makers are involved in designing the solution, the more likely they are to support the outcome and make helpful contributions. This turns an obstacle ("How will we get their support?") into an opportunity for collaboration.

'Political will is needed in order to implement eye health policies, and this can be generated by effective advocacy'

Any current inability to meet the existing demand for ophthalmological services is fertile ground for promoting our DR programmes. In Latin America, we can deliver clear messages to the health care authorities or legislators along the following lines:

1 Diabetes affects 7–10% of the population over the age of 20. Through screening, we may find retinopathy in as much as 30% of patients with diabetes, and 5% of patients with diabetes are likely to need laser treatment to reduce the risk of blindness.
2 Diabetes will be increasing in the future, and it is around twenty times cheaper to treat it earlier rather than later.
3 Eye health plans should be directed toward helping the most vulnerable people so as to achieve equal access to health care.

It is important to describe and publish the results of current and past prevention of blindness programmes. Publishing in scientific journals helps to provide the evidence you may need to convince decision makers. Persuading the media (newspapers, radio and television) to then write and talk about this evidence creates public pressure that will also persuade decision makers to act.

In Latin America, the epidemic of diabetes and DR poses such a great challenge to the population's health that we cannot manage alone. Through the leadership of the ophthalmology societies of Latin America, supranational bodies such as the Pan-American Association of Ophthalmology (PAAO), and other organisations such as the Pan-American Health Organization (PAHO) and the International Agency for the Prevention of Blindness (IAPB), we can forge alliances with national governments. These alliances, when added to the initiatives of non-governmental organisations, the ophthalmic industry, and civil society, can greatly assist with the implementation of national plans for the detection and control of DR.

Worldwide, any successful strategy to address DR will require close collaboration among everyone concerned: ophthalmologists, endocrinologists, physicians, mid-level eye care workers, outreach workers, pharmacists, public health specialists, community leaders, politicians, diabetes patients, and the general public.

There is a lot to do, but together we can do it!

Finding diabetes patients: thinking beyond the eye clinic

We can do nothing about diabetes or diabetic retinopathy (DR) unless we know where to find people who have diabetes.

Screening programmes are expensive, and countries with limited resources should not attempt a national screening programme for DR; it would be too complex and expensive to set up, administer, and manage.

It may be more cost-effective to work closely with our colleagues who see diabetes patients during the course of their work, such as physicians, diabetologists, pharmacists, and health insurers. We must encourage them to look for eye disease in their patients, or at the very least to refer their patients for regular retinal examination (provided that local treatment services are available).

We should also look for diabetes patients in our eye clinics, particularly those patients with cataract, as cataract can be a consequence of diabetes. We must check patients' blood sugar (if possible), carefully examine their eyes, and refer them for follow-up and/or further investigation (see the table on page 12). We must also ensure that they have access to a service to help them manage their diabetes.

However big or small our screening programmes, it is important to focus on more than the clinical and technical aspects (such as camera vs. ophthalmoscope or technicians vs. ophthalmologists). The biggest problems are administrative and managerial:

- How do we identify the diabetes patients we want to examine?
- How do we contact them to come for an examination?
- What do we do if they don't turn up?
- What do we do if a clear enough view of the retina is not possible?
- How do we record the findings, and how do we share that information? With whom do we share it, and when?
- Where and how are patients referred?
- How many of the people needing treatment actually attend and accept treatment after referral?
- What is the outcome of treatment?

In order for our screening to succeed, it is important to address these questions as early as possible in any planning process.

Experiences in India

Dr Rajiv Raman and his colleagues in India have reported that only 54% of the general practitioners or physicians they studied were aware of the need for annual retinal examinations and referral for patients with diabetes. Just 1.3% used direct ophthalmoscopes to detect DR, of which only half dilated patients' pupils before examination. The barriers they faced were lack of time, lack of ophthalmoscopes and lack of training.

According to Dr Raman, diabetes patients in India also regularly visit their pharmacists. Dr Raman recommends creating awareness among general practitioners and pharmacists about their role in identifying and referring patients at risk of DR. General practitioners could also be trained in the use of a direct ophthalmoscope as part of their continued medical education or continued professional development.

CASE STUDY

An integrated, mobile service for diabetic retinopathy in rural India


Mohita Sharma
Nayantara project lead and chief ophthalmologist


Anindya S Chakrabarty
Senior eye consultant


Pavan Rathi
Project Manager


RC Sharma
Director


Pratibha Goel
Senior eye consultant

Tiupati Eye Centre, C-8, Sector 19, Noida 201301, India.

The prevalence of diabetes among adults aged 30 years and above in rural India is 13.2%,[1] nearly double the global average for 2010. How can these individuals best be detected, treated and followed up? Rural communities have limited access to medical services, which leads to poor control of diabetes and hypertension. As a result, diabetic complications such as diabetic retinopathy (DR) may also be more frequent in rural than in urban areas.

In order to effectively address DR in rural India, we must:

- Find people with diabetes
- Examine their retinas
- Provide laser treatment if needed, often enough to halt the progression of DR and preserve sight
- Follow up those treated as well as those not treated on a regular basis
- Give advice on how people can prevent the complications of diabetes, including retinopathy.

This can be very difficult to achieve in rural India, where patients are likely to live far from treatment centres. Travel may be difficult and expensive, and can also lead to loss of earnings. This means that, even if treatment were free, patients may not come for yearly retinal examinations and those who need laser may not attend for follow-up or repeated treatment as often as needed.


Project Nayantara

The specially designed mobile unit is air conditioned and fully equipped with a slit lamp, visual field analyser, digital fundus camera, laser, and generator. INDIA

In rural areas, local physicians will care for people with diabetes, but many of them will not have the skills or the equipment to detect and refer patients with suspected DR. Many ophthalmologists may also not be confident in examining retinas and interpreting the findings, and the majority will not have skills in photocoagulation nor access to a laser. However, these individuals are an invaluable resource in the community: after training and capacity building, they have the potential to play a vital and cost-effective role in a DR programme.

Project Nayantara (in Hindi, 'Nayan' means eye and 'tara' means star) was devised as an integrated approach to address obstacles faced by patients as well as the limitations of local health professionals.

The project has a mobile examination and treatment unit (Figure 1), which contains a fundus camera and a laser. This unit, staffed by an ophthalmologist and allied personnel, travels to pre-determined locations in five districts in Uttar Pradesh, visiting each location once a month. This brings a high-quality diagnosis and treatment point very close to patients and does so regularly enough to ensure that patients are able to come for follow-up and repeated laser treatment when needed.

The equipment is only part of the solution, however. Project Nayantara relies on the relationships the team has developed with local physicians, diabetologists, ophthalmologists, and other health care workers. These health professionals refer patients with suspected DR to the mobile unit for examination and treatment: a very efficient use of the mobile team's time and skills.

The team builds local capacity by training the participating ophthalmologists in the use of the equipment and in the diagnosis and treatment of diabetic retinopathy. Training is also given to a variety of health workers, including local health promoters and general physicians. Physicians are taught how to perform a basic eye examination, including identifying signs of diabetic retinopathy using a direct ophthalmoscope. They are also encouraged to buy their own pocket ophthalmoscopes.


Project Nayantara

A local ophthalmologist receives hands-on training inside the mobile truck. INDIA

Financial sustainability

Running costs (approximately US $1,200 per month) are paid for by external funding for the first three years. After this, it is anticipated that costs will be covered

Continues overleaf ➤

by income generated from the mobile unit, making the project financially sustainable.

Treatment is provided free to those who cannot pay and at low cost to those who can. Patients who have a monthly income of less than US $30 are entitled to free treatment (this was true for approximately 60% of those treated in the initial phase of the project). Additional revenue is generated from private patients who are referred for investigations using some of the more sophisticated equipment in the mobile unit, such as scanners that measure body fat.

Any income generated is shared between the local ophthalmologist and the project team: the local ophthalmologist receives 40% as an incentive to 'earn while they learn' and the remaining income (60%) contributes towards running costs.

The capital cost of the equipment in the van is approximately US $140,000. This would have to be replaced roughly every seven years and will be paid for by the income generated from the unit in the years thereafter.

Results

Since Project Nayantara started in July 2010, the van has regularly visited 25 destinations involving 98 ophthalmologists, 142 general practitioners/physicians and 102 health workers. The team has examined 6,498 diabetes patients who were all referred by local health professionals. The team has completed 2,267 laser procedures and performed fundus fluorescein angiography on 1,827 patients. Each of these examinations and procedures also served as opportunities to train local ophthalmologists.

Of those requiring treatment, 95% have completed three sessions of pan-retinal laser photocoagulation (PRP) on the planned date and 100% have completed three sessions of PRP within three months of the planned date, signifying excellent compliance.

In the first nine months, 126 procedures (including intravitreal injections and vitreoretinal operations) were performed at the base hospital in Delhi as a result of referrals by the project team. These operations have been performed either free of charge or at minimal cost to the patient.

The intention is that, once ophthalmologists and diabetologists are confident and competent in detecting and treating DR in one location, the van will stop regular visits to that particular location and will move on to a new location.

This project, by training physicians and local ophthalmologists, achieves three goals:

- Patients do not have to travel more than 50 km to receive treatment for diabetic retinopathy
- Patients are followed up by a doctor in the same area who is a trusted and familiar caregiver
- After the mobile unit moves on to a new location, any new patients with diabetes will be well managed.

Initial experience with this integrated approach suggests that it increases patient compliance with treatment and follow-up. In addition, it has empowered local communities and health care professionals by transferring skills and building local capacity to diagnose and treat diabetic retinopathy.

References

1 Clara K, Chow P, Raju K, Raju R, Srinath Reddy K, Magnolia Cardona, et al. The prevalence and management of diabetes in rural India. Diabetes Care, 2006;116:180-5.

2 Namperulsamy P, Nirmalan PK, Ramasamy K. Developing a screening program to detect sight-threatening diabetic retinopathy in South India. Diabetes Care, 2003;26:1831-1835.

CPD: Test yourself

These continuing professional development (CPD) Test Yourself questions are based on the contents of this issue. You can use the questions to test your own understanding; we hope that you will also discuss them with your colleagues and other members of the eye care team. The questions have been developed in association with the International Council of Ophthalmology (ICO) and are based on the style of the ICO Advanced Examination: www.icoexams.org/exams/advanced

1. How can we prevent people from developing diabetic retinopathy?		True	False
a	Type 1 diabetes is preventable	☐	☐
b	The risk of Type 2 diabetes can be reduced by exercise and a healthy diet	☐	☐
c	Good control of blood pressure reduces the risk of developing retinopathy	☐	☐
d	The newest blood pressure drugs are better for prevention of diabetic retinopathy than older, cheaper medicines	☐	☐
2. What should we tell people with diabetes about diabetic retinopathy?		**True**	**False**
a	If you control your blood sugar, you will never get retinopathy	☐	☐
b	If you have diabetes, you will go blind because there is no effective treatment for diabetic retinopathy	☐	☐
c	You cannot tell whether or not you have retinopathy, and should be examined every year to detect it at an early stage	☐	☐
d	It is unreasonable for you to be upset about the long waiting times in our clinic – having your eyes checked should be your first priority	☐	☐
3. In a patient with diabetic maculopathy, which of the following are true?		**True**	**False**
a	If there are exudates within 1 disc diameter of the fovea, there is a risk of losing vision	☐	☐
b	There is no treatment for ischaemic maculopathy	☐	☐
c	All patients with treatable maculopathy will have reduced vision	☐	☐
d	Intravitreal steroid injection is the best treatment for diabetic macular oedema	☐	☐
4. When planning a programme for diabetic retinopathy, which of the following are true?		**True**	**False**
a	All patients with diabetes should have their retinas examined every year	☐	☐
b	Laser treatment should be available for everyone who needs it	☐	☐
c	Only ophthalmologists can detect diabetic retinopathy	☐	☐
d	Diabetes is only found in rich people who live in cities	☐	☐

ANSWERS

1. a. False. Type 1 diabetes is caused by auto-immune destruction of the insulin secreting cells in the pancreas and cannot be prevented. **b. True. c. True. d. False.** There is no evidence that any drug is superior to any other. The important thing is to lower the blood pressure.

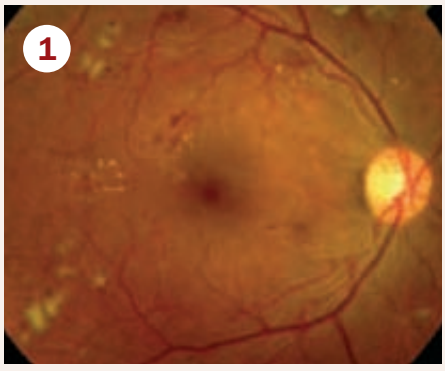
2. a. False. Perfect control is unobtainable. Good control reduces the risk of DR and delays it, but most people with diabetes will eventually get some DR. **b. False.** Very few people will go blind from DR if they are treated. It is important to inform them of the risks, but not to frighten them away. They need to know that effective treatments are available. **c. True. d. False.** People with diabetes have lives, families, and jobs. We need to ensure that detecting and treating retinopathy is simple, quick, and inexpensive.

3. a. True. b. True. c. False. Patients who have oedema near the fovea may still have normal vision, although they need treatment. **d. False.** A clinical trial showed that intravitreal steroid was not as good as laser, and may cause glaucoma.

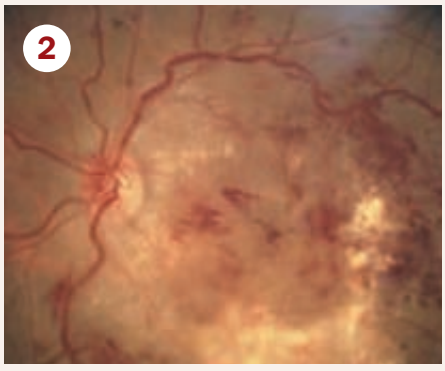
4. a. True. b. True. c. False. Non-ophthalmologists may be trained to detect retinopathy in photographs. **d. False.** Diabetes is more common in urban populations, but it is becoming much more common everywhere, including poor and rural communities.

Diabetic retinopathy quiz

Classify these photographs according to the table on page 12 and say which patients must be referred to a retinal clinic.

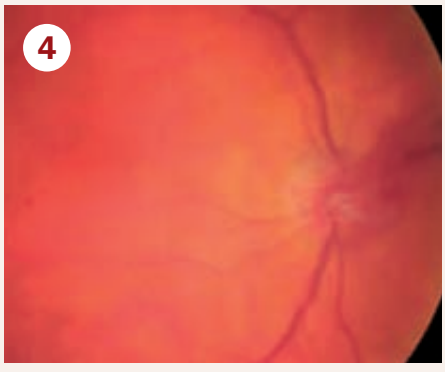


Richard Leung/Kings College Hospital



Clare Gilbert

Clare Gilbert



Clare Gilbert

ANSWERS

1. Moderate non-proliferative retinopathy, and maculopathy with exudates close to fovea. Should be referred for treatment of maculopathy.

2. Severe NPDR and maculopathy. Should be referred for treatment of maculopathy and watched closely for development of new vessels.

3. Mild non-proliferative retinopathy; pictures shows microaneurysms only. Should be examined again in 12 months.

4. Proliferative diabetic retinopathy; picture shows disc new vessels. Requires urgent referral for pan-retinal laser.

How to clean eyelids

Sue Stevens
Former Nurse Advisor, Community Eye Health Journal, International Centre for Eye Health, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK.

Before performing an eye procedure

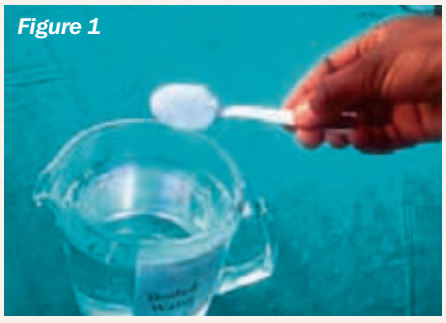
- **Wash your hands** (and afterwards too).
- Position the patient comfortably with head supported.
- **Avoid distraction** for yourself and the patient.
- Ensure good lighting.
- Always **explain to the patient** what you are going to do.

Reasons for cleaning eyelids

- **Basic eye hygiene:** to remove any discharge before instillation of eye drops or applying eye ointment, or before applying post-operative eye dressings.
- **Blepharitis:** to remove crusting on the eyelid margins.

You will need

- sterile cotton buds
- sterile gauze swabs
- salt
- sodium bicarbonate (more effective than salt for blepharitis)
- teaspoon
- jug
- small sterile pot



Pak Sang Lee

Pak Sang Lee

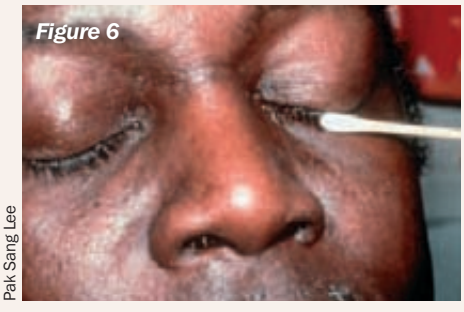
Preparation

- Dissolve 1 heaped teaspoonful of salt or sodium bicarbonate in a jug containing 500 ml of boiled water (half a litre); allow this solution to cool (Figure 1).
- Pour a very small amount of the solution into a small sterile pot on a clean surface (Figure 2).

Pak Sang Lee

Pak Sang Lee

Pak Sang Lee



Pak Sang Lee

Method

1 The eyelashes

- Ask the patient to close both eyes.
- Take a folded gauze swab or cotton bud.
- Moisten the swab or bud with the prepared solution (Figures 3 and 4).
- With the swab or bud, clean gently along the eyelashes in one movement, from inner to outer canthus (Figures 5 and 6).
- Discard the swab or bud after use.

2 The lower eyelid

- Ask the patient to look up.
- With one hand, take a new swab or bud and moisten it in the solution.
- With the index finger of the other hand, gently hold down the lower eyelid.
- With the swab or bud, clean gently along the lower eyelid margin in one movement from inner to outer canthus (Figures 7 and 8).
- Discard the swab or bud after use.

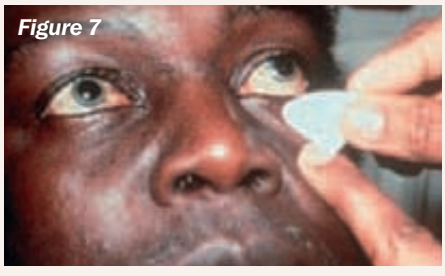
3 The upper eyelid

Note: extra care is needed when cleaning the upper eyelid margin. Try to keep the cornea in view throughout and avoid touching it with the swab or bud.

- Ask the patient to look down.
- With one hand, take a new swab or bud and moisten it in the solution.
- With a thumb or finger of the other hand, gently ease the upper eyelid up against the orbital rim (just below the eyebrow), taking care not to put any pressure on the eyeball.
- With the swab or bud, clean gently along the upper eyelid margin in one movement from inner to outer canthus (Figures 9 and 10).
- Discard the swab or bud after use.

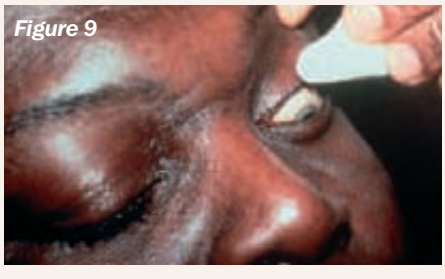
Note: always use a new swab or bud each time

- If the eyelids are very sticky or encrusted, it will be necessary to repeat any part of the above procedure until all debris or discharge is removed.
- Finally, discard the unused remainder of the solution.



Pak Sang Lee

Pak Sang Lee



Pak Sang Lee

Pak Sang Lee

How to safely use a portable electric generator

Pak Sang Lee
Technical Administrator, Division of Epidemiology & Genetics, UCL Institute of Ophthalmology & Moorfields Eye Hospital, 11-43 Bath Street, London EC1V 9EL, UK.

Ismael Cordero
Formerly Senior Clinical Engineer, ORBIS International.
Email: ismaelcordero@me.com

If your facility does not have a permanent standby generator to use for temporary power outages, or if you are conducting mobile clinic activities in areas without electrical power, you may need a portable generator to power your electrical devices.

A generator that isn't powerful enough may overheat and catch fire; it can also damage equipment. To calculate the generator capacity you need, add the wattage of all the equipment you want to use at the same time (you can find this on the equipment's label or in its manual). The stated 'running rating' or 'continuous rating' of the generator must be at least 1.3 times higher than this figure. This will ensure that you are running the generator at no more than 75% of its capacity, which is efficient and will prolong the generator's life.

Use a separate voltage regulator and a surge suppressor in order to guarantee stable and 'clean' voltage to your delicate eye care equipment. The capacity of the voltage regulator and surge suppressor should be calculated in the same manner as described for the generator.

Using your generator

You will need:

- Fuel (consult the generator manual)
- Oil (recommended by manufacturer)
- Cable reel
- Voltage regulator
- Surge suppressor socket strip
- Any other socket strips needed to plug in your eye equipment.

Starting the generator

1. Fill the fuel tank and check the fuel indicator to ensure it is full. Consult the manual to find out how long the generator will run on a full tank.
2. Check the oil level. Use only the type of oil recommended by the manufacturer.
3. Switch on the fuel.
4. Switch on the choke. Only use the choke when the engine is cold.
5. Make sure the voltage regulator is disconnected from the cable reel. Connect the plug from the cable reel to the generator socket (Figure 1).

Pak Sang Lee

Figure 1. Connecting the cable reel to the generator. Note: unroll the cable reel before you plug the voltage regulator into the cable reel socket

6. Switch the generator's rocker switch to the 'on' position. Pull the starting cord swiftly towards you. You may have to do this a few times before the engine starts.
7. Once the engine starts and has stabilised, slowly move the choke lever back to the 'off' position.

Pak Sang Lee

Figure 2. Voltage regulator

8. Connect the voltage regulator (Figure 2) to the cable reel socket and turn it on. Make sure the cable is unrolled, that is, all the cable is out of the cable reel. This will prevent overheating.
9. Connect the surge suppressor socket strip (Figure 3) to the voltage regulator and turn it on.

Pak Sang Lee

Figure 3. Surge supressor socket strip

10. Plug in other socket strips. Now plug in your ophthalmic equipment.

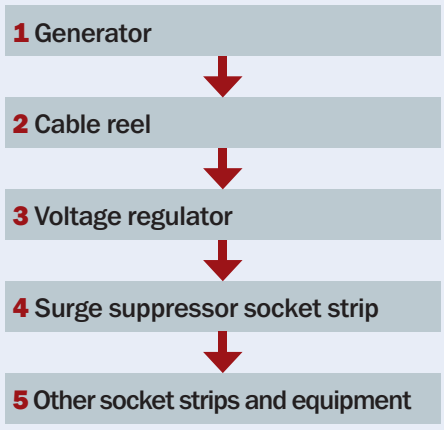


Figure 4. Connection sequence. Connect devices in the order shown above. Before powering on any device, make sure that the device preceding it in the sequence is connected and turned on

Stopping the generator

1. Switch off all the equipment.
2. Switch off the surge suppressor power socket strips.
3. Switch off the voltage regulator.
4. Switch off the generator by pushing the generator's rocker switch to the 'off' position.

General operation and safety tips

- Keep your generator in a level, clean, and dry environment.
- Never refuel your generator while it is running since fuel spilled into a running engine can cause fires.
- Never operate a portable generator inside a building or near windows and doors. It produces deadly carbon monoxide gas.
- Most generators are very noisy. Make sure that the generator is placed as far away from the eye care unit as possible so that it does not disrupt patient care.
- Keep your generator ready for use by testing it on a regular basis (once a month is a good rule of thumb).
- On electric start models, charge the battery on a regular basis.
- Keep fresh fuel on hand at all times, and follow safety advice on storing and using fuels. Gasoline and biodiesel have a shelf life of about six months; diesel lasts for about a year.
- Engine parts get very hot during operation. Severe burns may result if touched.
- Never attempt to repair an electric generator. Only a qualified service technician should perform repairs.

Note: improper use or installation of an electric generator can cause property and equipment damage, serious injury, and even death.

The *Trachoma Update* series is kindly sponsored by the International Trachoma

The Zithromax® donation for trachoma elimination – how to apply for and manage the drug

Lisa A Rotondo
Deputy Director, International Trachoma Initiative, 325 Swanton Way, Decatur, GA 30030.

Rachel Seligson
Senior Manager, Global Logistics and Supply, Pfizer Inc.

All readers of the *Community Eye Health Journal* who are responsible for managing trachoma programmes at national, regional, or district level need to be familiar with the requirements for Zithromax® donation. The generous global donation of the antibiotic Zithromax® by Pfizer Inc. through the International Trachoma Initiative (ITI) can play an important role in the successful elimination of blinding trachoma. Therefore, the procedures required to apply for and manage the product need to be understood and followed.

Countries obtain donated Zithromax® through an application to ITI. The application is a cooperative process through which ITI, governments of trachoma-endemic countries, and other partners work together towards the national goal of eliminating blindness caused by trachoma.

Since 1998, ITI has managed Pfizer's donation of Zithromax.® This drug is an effective broad-spectrum antibiotic that, when administered once annually for a consecutive number of years, works to reduce the reservoir of Chlamydia trachomatis infection in endemic communities. By distributing antibiotics in conjunction with surgical interventions, health education, and increased access to water and sanitation (known as the SAFE strategy), national trachoma programmes can stop disease transmission and progression to blindness.

Since the International Trachoma Initiative's inception, Zithromax® has been donated to 23 countries and over two hundred million doses have been administered. Careful planning is required to ensure that national programmes receive the right quantity of drugs in a timely manner and that appropriate supply chain systems are in place to manage the product when it arrives in the country where it will be used.

Elizabeth Kurylo/International Trachoma Initiative

Boxes of Zithromax,® ready for mass drug administration in a community. UGANDA.

Application

The Zithromax® application process starts nearly eighteen months before the drug arrives at its destination. It requires a dialogue between the relevant ministries of health, ITI, Pfizer, and international implementing partners (non-governmental organisations). The complex supply chain begins with Pfizer's suppliers, who provide raw materials, bottles, and packaging. Pfizer then manufactures the drug and arranges transport to the endemic countries. On arrival, the government, represented by the ministry of health, is expected to clear the drugs, store them safely, manage their distribution through mass drug administration (MDA), and implement the other elements of the SAFE strategy.

ITI works directly with national trachoma programme managers who are designated by the ministry of health. ITI sends a new application form each year in November and the ministry must submit the completed application by February the following year. The application includes district-level data on past treatments, the latest trachoma prevalence data, a long-term forecast, and a current drug inventory. Despite the difficulty of forecasting in the long term, a 3–5 year needs assessment is critical to planning. The application process allows ITI to see whether there are programme gaps, allows Pfizer to plan raw material requirements, and allows the ministry of health to review their country plans and to ensure that partners are available to assist with all aspects of the SAFE strategy.

Between February and April, ITI analyses the data on drug requirements from all existing countries and new country applicants. Prior to the World Health Organization (WHO) annual trachoma alliance meeting (GET2020) in April, each country representative meets with members of ITI, Pfizer, WHO, and other implementing partners and key stakeholders in order to review the plan and produce a forecast of Zithromax requirements. This meeting also provides an opportunity to assess partner support for SAFE strategy implementation and to review baseline and impact prevalence surveys.

From these meetings, Pfizer can determine the overall drug requirements. The company can then plan manufacturing capacity for the following year, taking into account other business requirements. Any missing or additional data required for the applications is followed up by ITI in May.

In June, a final Zithromax® application is reviewed by the Trachoma Expert Committee (TEC), an independent body of international experts in public health, ophthalmology, blindness prevention, and the SAFE Strategy. TEC members provide guidance to ITI on strategic, technical and operational issues during two semi-annual meetings. Based on the TEC recommendations, each ministry of health applying for Zithromax® is sent either a memorandum of understanding (MOU) for the following year detailing the quantity of Zithromax® and the districts approved for distribution, or a letter explaining why the country application was unsuccessful with suggestions to

help the country to meet requirements in the future.

Once the MOU has been signed by the ministry and returned to ITI, delivery of Zithromax® is scheduled for approximately one to two months prior to the time when MDA is to take place. For countries that are already involved and that have received Zithromax® in past years, there needs to be an updated inventory of any drugs already in the country, including those with a short shelf life and those about to expire. On the basis of this information, adjustments to the donation forecast are made.

Supply chain

Currently, Zithromax® is manufactured in two formulations, pediatric powder for oral suspension for children ages six months to five years, and tablets for people over five years of age. The product is manufactured at various sites in Europe or the USA. Once manufactured, the product is stored in one of Pfizer's European warehouse locations where the goods await allocation to recipient countries. Due to the large size of each shipment (hundreds of pallets for each country), several airplane loads may be required. Upon arrival in the country, the ministry of health must ensure customs clearance and transport to central medical stores and to regional warehouses in preparation for MDA. All charges are the responsibility of the ministry of health. A detailed description of best practices for in-country supply chain can be found in "Zithromax® in the Elimination of Blinding Trachoma: A Program Manager's Guide" at **www.trachoma.org/guides-and-manuals**

Countries seeking Zithromax®

The Zithromax® donation is available only to governments of poor endemic countries for the elimination of blinding trachoma. Countries that have been approved for the donation may use it for MDA, administration after trichiasis surgery, or as part of surveillance or prevalence surveys, in addition to special pre-approved uses by ITI and the TEC.

National ownership and proven commitment to the elimination goal is key for a successful application and continued donation of Zithromax.® The requirements for Zithromax® donation (including evidence of need, training of health care staff, SAFE strategy implementation, effective distribution strategies, and monitoring and evaluation) may be demanding for under-resourced and overstretched national health programmes. However, they are necessary to manage and monitor the Zithromax® donation to aid in the elimination of this painful and blinding disease.

EXCHANGE

Using a lighter to heat a cautery

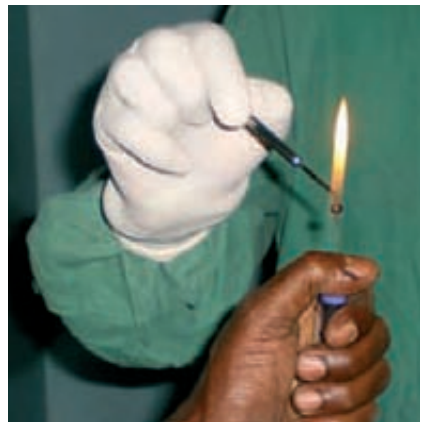
Dear Editor,

Those of us who are extracapsular cataract surgeons have all experienced delays in cauterizing the eye due to difficulty in lighting a spirit lamp containing methylated spirit with too much water mixed in it. What should be a simple and short stage of the operation becomes tense and prolonged, cautery may be inadequate, and there is inefficient use of anaesthetic time.

We have found that using a cigarette lighter for heating is a viable alternative.

In Tanzania, the cigarette lighter illustrated is easily available and can be purchased cheaply from local stores, costing only TZS 500 (around US $0.30). The flame effectively heats the ball of the Wordsworth cautery, and soot accumulation can be avoided if the cautery is held in the blue rather than the yellow part of the flame.

So far, we have tested two models of cheap lighter. Not all are suitable, as the top of the lighter becomes hot and parts may melt during prolonged use. For this reason also we recommend that surgical gloves are not worn by the person holding the lighter. When using a lighter of the type illustrated, we have found this method to be safe, easy to operate, and effective both in our own theatre and on outreach.



Brian Savage

Wordsworth cautery being heated in blue part of the flame. (The flame here is turned much higher than normal for illustration purposes)

Using a lighter will also reduce the risks of fire in the theatre caused by gowns or drapes coming in contact with the flame of an unattended spirit lamp, when operator or assistant are absorbed by a challenging operation. I have seen this once: surgical gowns are surprisingly flammable!

In general anaesthetic situations, the usual precautions regarding inflammable gases and naked flames should be observed.

Brian Savage

Examples of the lighter we have found effective

Brian Savage
Ophthalmologist, Haydom and KCMC Hospitals, Tanzania.

USEFUL RESOURCES

Diabetic retinopathy

Book

Diabetic Retinopathy for the comprehensive ophthalmologist.
Walker J.

This book will be available in electronic format on the new Community Eye Health Update CD, due out with the December 2011 edition of this journal. Look out for your free copy! The book is also available for purchase (US $39.99, soft cover, free delivery) or free download (nine PDF files of 14–59MB each) from **http://drcobook.com**. Please note that the book is now three years old and that new information has become available, in particular about intravitreal injections. However, the book also covers timeless topics such as informed consent and diabetes control.

Online resources

Diabetes grading scheme: International Clinical Diabetic Retinopathy And Diabetic Macular Edema Disease Severity Scales. International Council of Ophthalmology, October 2002.
http://archive.icoph.org/standards/gdrp.html

Patient information about diabetic retinopathy (pdf, 200KB)
www.retinalscreening.nhs.uk/userFiles/File/diabeticRetinopathyFacts.pdf

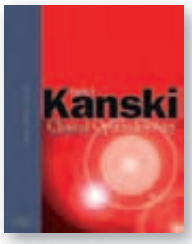
Patient information about a DR screening programme: examples in several languages (PDF, 356KB maximum) **www.dhsspsni.gov.uk/public_health_diabetic_retinopathy**

Detailed patient information about screening for DR (pdf, 200KB) **www.retinalscreening.nhs.uk/userFiles/File/EyeScreeningForDiabetes.pdf**

Patient information about laser treatment (pdf, 200KB)
www.retinalscreening.nhs.uk/ userFiles/File/PreparingForLaserTreatmentDR.pdf

News

Photo and video competition winners



Thank you very much to all our readers who entered this competition. The winner of the video competition is Stephen Thompson of the Universidade Lúrio in Mozambique, who will receive a copy of Kanski's Clinical Ophthalmology kindly donated by Elsevier (worth UK £164). First prize in the photo competition goes to Andrew Potter, Benin. Tatowela Mmoloki, Botswana, Mohsin Alam, India and Sr MG King, South Africa share second place. All winners will receive book prizes.

Have your say: low vision

Our March 2012 issue is about managing adults and children with low vision. Have you had a useful or interesting experience in low vision that you would like to share with other readers? Do you have any questions you would like to ask our experts? Write to: The Editor, International Centre for Eye Health, London School of Hygiene and Tropical Medicine, London WC1E 7HT, UK. Email: **editor@cehjournal.org** Deadline: 15 January 2012.

Get your own copy

Do you get your own copy of the *Community Eye Health Journal*? Do you know anyone else who would like their own, free copy? Or have you moved or changed jobs? Send your up-to-date details to Anita Shah, International Centre for Eye Health, London School of Hygiene and Tropical Medicine, London WC1E 7HT, UK. Email: **admin@cehjournal.org**

Online Sightsavers journal

Insight Plus is a practitioner journal consisting of learning and best practice from across the many different Sightsavers programmes in Africa, Asia, and the Caribbean. Each issue focuses on a different theme and is published twice a year. The journal includes case studies, opinion papers, and learning summaries. Please information, please contact: **learning@sightsavers.org** for information. Issues may be downloaded from **www.sightsavers.org/InsightPlus**

Courses

Community Eye Health Institute, University of Cape Town, South Africa

For information about VISION 2020 certificate courses in 2012, a postgraduate diploma in community eye health (PGDip) in 2013, or a Masters in Public Health (community eye health) in 2013, contact Zanele Magwa, Community Eye Health Institute, University of Cape Town, Private Bag 3, Rondebosch 7700, South Africa. Tel: +27 21 404 7735. Email: **ntombizanele.magwa@uct.ac.za**

International Centre for Eye Health

MSc in Public Health for Eye Care. From September 2012 to September 2013 or part-time over two years. Apply before April 2012. For scholarships and details of application, write to: Registry, LSTHM, Keppel Street, London WC1E 7HT, UK. Tel: +44 207 299 4646 or visit **www.lshtm.ac.uk/prospectus/masters/mscphec.html**

Kilimanjaro Centre for Community Ophthalmology (KCCO), Tanzania

For information on courses, contact Genes Mng'anya, KCCO, Good Samaritan Foundation, PO Box 2254 Moshi, Tanzania. Tel: +255 27 275 3547. Email: **genes@kcco.net** or visit **www.kcco.net**

Lions SightFirst Eye Hospital, Nairobi, Kenya

Small incision cataract surgery for ophthalmologists wishing to upgrade from ECCE. Duration: 1 month. Courses run every month. Cost: US $1,000 for tuition and US$ 500-700 for accommodation and meals. Write to: The Training Coordinator, Lions Medical Training Centre, Lions SightFirst Eye Hospital, PO Box 66576-00800, Nairobi, Kenya, call +254 20 418 32 39, or email **training@lionsloresho.org**

International Centre for Advancement of Rural Eye Care, LV Prasad Eye Institute, India

Community Eye Health Diploma (6 months, US $8,000) and Masters (11 months, US $21,000). Courses start in January 2012. Contact S Sheeladevi, International Centre for Advancement of Rural Eye Care, LV Prasad Eye Institute, Kismatpur Campus, LV Prasad Marg, Hyderabad 500 034, India. Email: **sheela@lvpei.org**

Lions Aravind Institute of Community Ophthalmology

Instrument maintenance courses with a trainee: trainer ratio of 1:1. Courses start on 1 Feb, 1 Apr, 1 June, 1 Aug, 1 Oct and 1 Dec 2012. Duration: Four weeks. Cost: US $400 (including tools). Visit **www.aravind.org/education/coursedetails.asp** or write to: Prof V Srinivasan, LAICO, 72, Kuruvikaran Salai, Gandhi Nagar, Madurai 625 020, Tamil Nadu, India. Email: **v.srinivasan@aravind.org**

Next issue

Eimien Wolvaardt Ellison

The next issue of the *Community Eye Health Journal* will be on **Instruments and consumables**