Risk factors, screening and treatment of diabetic eye disease

Sheila Glenn

ARTICLE POINTS

1 Risk factors for diabetic retinopathy include duration of diabetes, poor control, hypertension and hyperlipidaemia.

2 The key component of screening is regular eye examination. Expert groups in Europe advocate yearly screening.

3 Screening tools include ophthalmoscopy and retinal photography, which can be used independently but are more effective when used together.

4 Retinopathy can be treated with health education, laser and/or vitreoretinal surgery.

5 The success of the treatment is dependent on whether maculopathy is present and the time of presentation.

KEY WORDS

- **Diabetic retinopathy**
- **Risk factors**
- **Screening**
- **Visual impairment**

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Introduction

In the early stages of diabetic retinopathy, the affected individual may not be aware of any symptoms, but if these are allowed to progress, blindness may result. However, the disease can be detected by careful examination of the retina. Williamson and Keating (1998) maintain that providing full retinopathy screening for people with diabetes would significantly reduce the incidence of blindness. This article identifies the risk factors associated with the development and progression of retinopathy, and looks at the screening process and the effectiveness of contemporary treatments.

It has been estimated that in people with diabetes of 15 years duration, approximately 2% will have become blind and about 10% will have developed severe visual impairment (WHO, 1998). Figure 1 shows a fundus with diabetic retinopathy.

Understandably, sight loss and blindness have a huge negative impact on the affected individual and his/her family. Any strategy that could minimise this trauma is worthy of consideration by the NHS. One such strategy is a screening programme carried out by a range of healthcare professionals. However, to be effective, these professionals need to have the necessary skills and resources.

Risk factors

The duration of diabetes has long been linked with the development of diabetic retinopathy (Klein et al, 1992). Roy (2000) also identified an increase in the incidence of diabetic retinopathy with age and duration of the disease. Little can be done about these factors although other more treatable risk factors have been identified. These include poor diabetic control, hypertension and hyperlipidaemia. It is in these areas that the diabetic nurse can potentially influence the progression of the disease.

Poor diabetes control

According to Klein et al (1992) the glycosylated haemoglobin (HbA_{1c}) level is a strong predictor of risk of progression to proliferative retinopathy. In their study, individuals with HbA_{1c} >11.7% had an almost four-fold higher risk than those with HbA_{1c} >8.5% (all patients were receiving insulin and had an onset of diabetes after 30 years of age; average age was 65.4 years). Weight reduction in patients with type 2 diabetes and overweight patients with type 1 diabetes is the first step in helping patients to achieve good control. Poor diabetic control in the context of retinopathy may be an indication for the earlier use of insulin in type 2 diabetes (Shotliff and Herbert, 1997).

Hypertension

There is a link between high blood pressure and diabetic retinopathy (Barnett, 1994). Klein et al (1992) looked at patients diagnosed with diabetes before 30 years of age who required insulin, and it was found that both systolic and diastolic hypertension were associated with the progression of diabetic retinopathy. The microangiopathy (small vessel disease) associated with hypertension may affect all of the small blood vessels in the body, but the most apparent clinically is in the eyes (retinopathy). The mechanism through which hypertension may contribute to the evolution of retinopathy is unknown, although increased capillary leakage may be a factor.

Hyperlipidaemia

The existence of a link between proliferative retinopathy and serum cholesterol is currently under debate. Patel et al (1993) indicated that there is a connection. This small study (n=86) investigated the association between

hyperlipidaemia and retinopathy. The data suggested that, compared with patients with serum cholesterol levels below 5.30 mmol/l, those with levels greater than 6.99 mmol/l had a more than four-fold higher risk of developing proliferative retinopathy. A higher risk for the development of maculopathy was also reported (over seven-fold higher).

Such data highlight the need for healthcare professionals to consider hyperlipidaemia in the context of vision loss associated with diabetic eye disease.

The reason for screening

Diabetic retinopathy is associated with a range of symptoms as it progresses from background retinopathy to the more sight-threatening proliferative retinopathy.

In the early stages, the small blood vessels of the retina become blocked and swollen. There is often leakage of blood and lipid material. In the more advanced stage (proliferative retinopathy), the retina becomes ischaemic and may trigger new blood vessel growth. These new vessels are of poor quality and prone to the development of aneurysms.

Retinopathy may be present for many years without any symptoms of visual impairment. Vision loss is dependent upon the area affected and the presence of other complications such as traction detachments of the retina, cataract and maculopathy (Glenn, 1999).

Regular screening can detect progression of the disease in asymptomatic cases, and thus enable appropriate treatment to begin before any significant sight loss occurs. The importance of screening was reinforced by the St Vincent Declaration, a European directive on the need to provide screening (British Diabetic Association,1995).

The main component of screening is regular eye examination. The consensus among expert groups in Europe is that yearly screening is appropriate (British Diabetic Association, 1997; The Royal College of Ophthalmologists, 1997). Screening can be carried out by two methods: ophthalmoscopy or retinal photography.

Ophthalmoscopy

Ophthalmoscopy involves dilation of the pupil and detailed examination of the retina. The sensitivity varies between different healthcare professionals. The early-treatment Diabetic Retinopathy Study Research Group (1998) found that when GPs used ophthalmoscopy, sensitivity was poor (33% for any retinopathy and 67% for sight-threatening retinopathy). In contrast, opticians were found to have 48% sensitivity for sight-threatening retinopathy.

Ophthalmoscopy links the screening process with assessment. Given the crucial role of ophthalmoscopy, the screener should possess a certain level of knowledge and skill. One could argue that for screening to be effective the screener (GP, nurse or optician) should be trained and regularly updated in the use of the ophthalmoscope. Competence in the use of this tool will also be related to frequency of use.

Retinal photography

With retinal photography, the screening and the assessment processes are distinct. The photographs provide hard evidence of the disease process.

Retinal photography can be carried out in a range of settings, including mobile diabetic eye units. The photographs may be read by a suitably trained reader. Alternatively, they may be assessed by a collaborating ophthalmologist who would then prescribe the necessary treatment.

Williamson and Keating (1998) suggest that advantage be taken of the technological revolution. They maintain that digitised images can be sent to a qualified reader via

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Figure 1. Fundus with diabetic retinopathy.

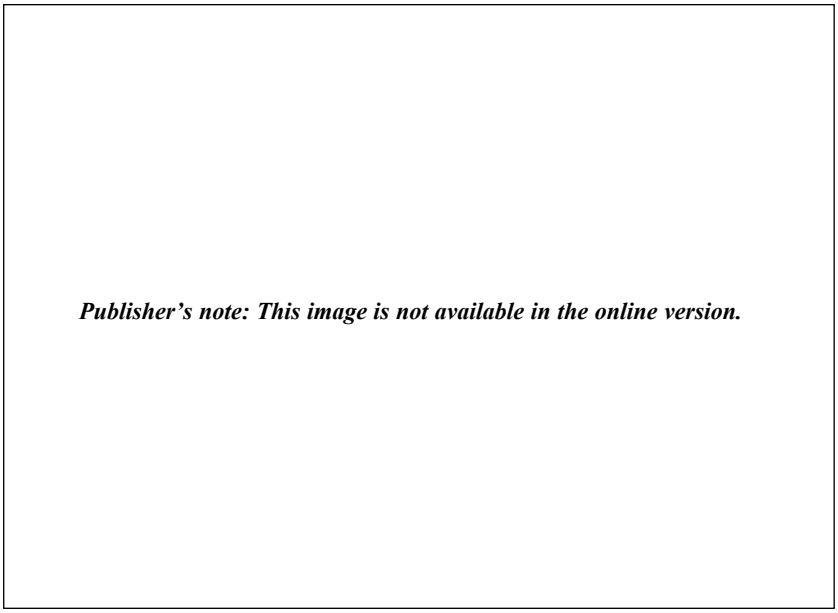

Figure 2. Angiograph showing retinopathy.

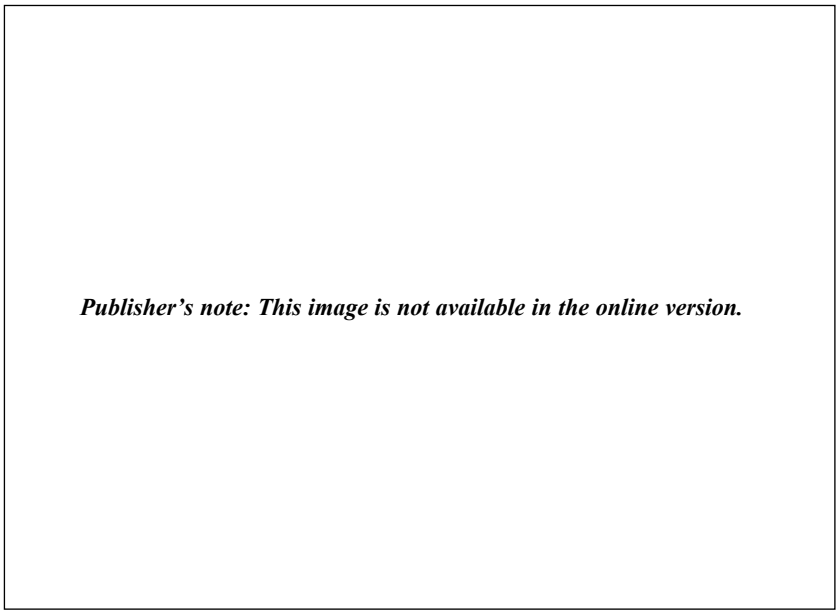

Figure 3. Angiograph showing burn marks around the periphery following laser treatment.

computer, e.g. e-mail. In this way, images could be accessed, examined and stored.

Ophthalmoscopy and photography should be considered complementary screening tools. When used together by ophthalmologists or optometrists, a high degree of accuracy can be attained (Taylor et al, 1999). Again, it has been found that sensitivity falls below acceptable levels when screening is carried out by GPs (Diabetic Retinopathy Study Research Group, 1998). This finding was at odds with an earlier study by O'Hare et al (1996) showing that assessment and referral by GPs improves when combined screening modalities are used. This would involve supplementing direct ophthalmoscopy through dilated pupils with photography and specialist review of all films.

After referral to a consultant ophthalmologist, a fluorescein angiography is performed. Briefly, a dye (fluorescein) is injected into the general circulation via the arm. A series of rapid monochrome photographs, taken through a dilated pupil, follow the dye as it passes through the retinal circulation (arterioles, capillaries and venules). Any vascular abnormalities, such as occlusions, leaking vessels, microaneurysms and retinal oedema, are clearly highlighted. Figure 2 shows an angiograph of a patient with retinopathy.

Can retinopathy be treated?

The simple answer is yes, although the prognosis depends on whether maculopathy is present and the point at which the retinopathy was detected. The macula is the part of the retina that provides detailed visual information. For this reason, this area is not treated by laser because any residual acute vision would be destroyed.

The earlier the diagnosis the better the chances of preventing major sight loss. There are three usual forms of treatment for diabetic retinopathy:

- Health education regarding good dietary and blood pressure control and its links with the disease process
- Laser treatment to the retina
- Vitreoretinal surgery (not all patients will progress to this stage).

Health education

To maximise compliance with treatment, it is imperative that the patient understands the relevance of the treatment in relation to his/her diabetes.

In this context, the nurse's role is to help the patient assimilate all the facts. The aim is for the patient to understand the processes occurring within the retina. Subsequently, he/she will then be able to ask relevant questions of the medical and nursing staff, and make informed decisions regarding diet, blood pressure and any treatment offered.

Laser treatment

Patients offered laser treatment often have mixed emotions: fear of blindness and of the

laser itself, and hope that the treatment will prevent further deterioration of sight.

Laser treatment is performed as an outpatient procedure and takes 20 minutes on average. The patient is seated in front of the laser, which resembles the slit-lamp microscope with which he/she is more familiar. The chin is placed on a rest and the patient is asked to look at a special pin-point light. A special contact lens is placed on the cornea following the instillation of local anaesthetic drops to help the ophthalmologist gain a fuller view of the retina. The patient is warned that he/she will experience bright flashes of light. The laser beam focuses on, and destroys, the damaged blood vessels at the back of the eye. Other ophthalmic structures are left intact.

Many cases of proliferative diabetic retinopathy can be stabilised by bombarding most of the peripheral retina — a procedure called panretinal ablation. This reduces the oxygen requirement of the retinal tissue, thus reducing the stimulus for new vessel growth (Perry and Tullo, 1995). In background retinopathy, the ophthalmologist may decide to burn only localised vessels in an attempt to stop any new or further bleeding points.

Laser treatment is not usually painful. However, during firing, some patients experience a sensation similar to the static electricity one feels when removing clothing. After the treatment, the patient may experience a dull ache. This can normally be controlled with mild analgesia. Figure 3 shows burn marks around the periphery following laser treatment.

The rationale underlying laser treatment is the preservation of detailed colour vision. Extensive laser treatment leads to some loss of peripheral and night vision, which may cause problems for the patient. However, the alternative — loss of central and colour vision — would be much more debilitating.

Vitreoretinal surgery

In more severe cases of retinopathy, vitreo-retinal surgery may be performed. This is often carried out by an ophthalmologist specialised in this field of work.

The procedure involves the removal of the jelly-like vitreous. This is usually in an attempt to remove a haemorrhage and/or to relieve traction retinal detachments. The vitreous is usually replaced by infusion fluid or, in more complex cases, oil or gas.

Conclusion

Diabetic retinopathy is the most common cause of blindness in people of working age in industrialised countries. Visual impairment is not only devastating for the patient but also carries economic implications for both the patient and the health service. Regular eye examination carried out by suitably qualified personnel with timely laser intervention can reduce the risk of severe vision loss. There is therefore a strong argument for making screening programmes for retinopathy and associated risk factors available to all patients with diabetes. This needs to be efficiently organised at a local level to ensure adequate population coverage. ■

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