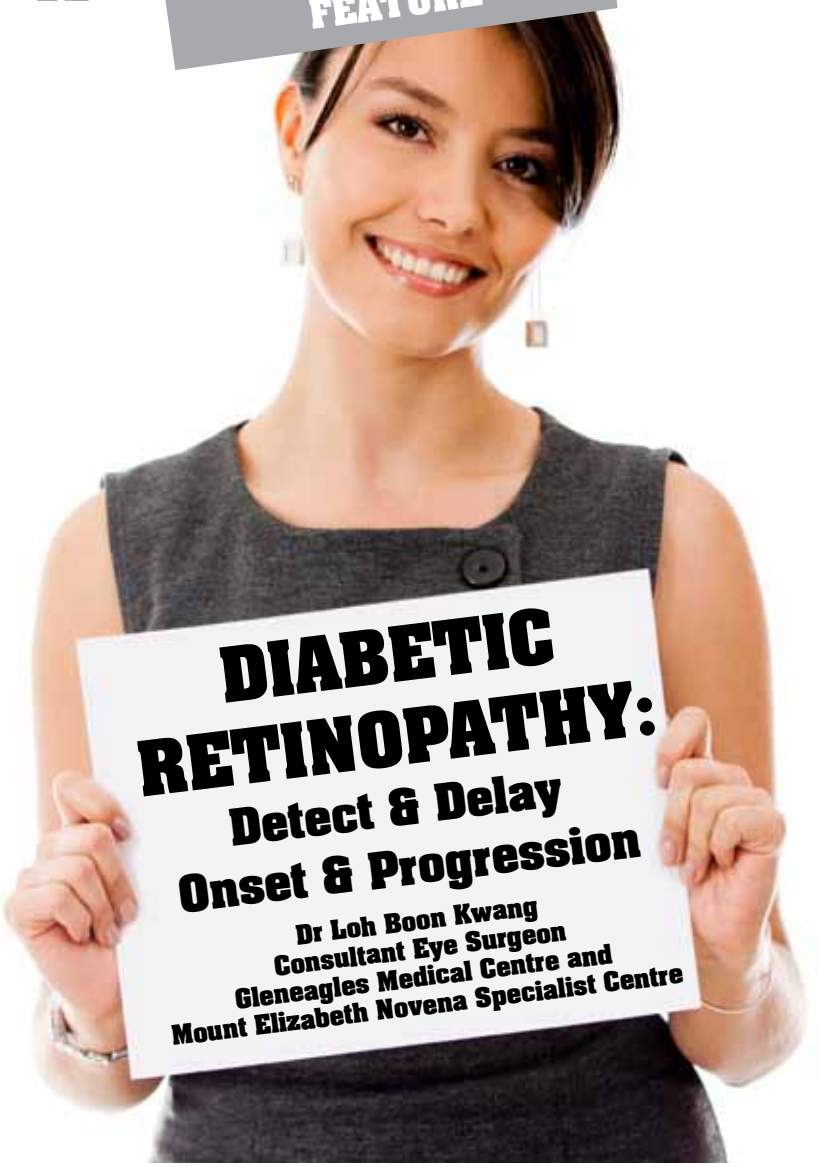

Diabetes mellitus has increased in prevalence worldwide and in Singapore, the prevalence of diabetes has also increased; 13% of the people living in Singapore now have diabetes.

Diabetic retinopathy, a disease of the retina due to diabetes affecting its small blood vessels, is identified in one-third of patients with diabetes.

One-third of such patients may have vision-threatening retinopathy defined as severe retinopathy where there is increased bleeding of the retina or macular edema where the central part of the retina is swollen.

Diabetic retinopathy is the major complication of the eye associated with diabetes and represents the leading cause of legal blindness in the working-age population of developed countries.

Regular eye examination is important for the detection and monitoring of diabetic retinopathy. Systemic control of the blood glucose, blood pressure and possibly blood lipids plays an important role in delaying the onset and the progression of diabetic retinopathy.

When more severe forms of diabetic retinopathy are detected, laser therapy of the retina, injections of medicine into the eyeball and vitreoretinal surgery are useful to help preserve and even improve vision of patients.

Screening

Regular eye examination of patients with diabetes is crucial for the detection and monitoring of diabetic retinopathy as the patients will usually have no symptoms. This enables the more serious forms of diabetic retinopathy to be treated early to prevent vision loss. Those with milder forms of the disease can then be followed up regularly to detect any progression. They can also be counselled actively on the importance of good systemic control of blood glucose, blood pressure and blood lipids.

Systemic Control

Blood Sugar Control

High blood sugar levels promote the development of diabetic retinopathy. High blood sugar levels are associated with increased glycated haemoglobin. Haemoglobin is found in red blood cells and In the presence of high blood sugar, glucose combines with the haemoglobin to form glycated haemoglobin (HbA1c). Blood level of HbA1c indicates the control of diabetes in the patient over the last three months. Two large studies of patients conducted in the US and UK showed that good blood sugar control (as measured by HbA1c) reduced the onset and progression of diabetic retinopathy in diabetic patients who relied on insulin injection or oral medications to control blood sugar. Every percentage reduction in HbA1c lowered the risk of diabetic retinopathy by about 30%.

Blood Pressure Control

High blood pressure worsens diabetic retinopathy as the high blood pressure damages the small blood vessels of the retina. Many studies have shown that hypertension (high blood pressure) is an important risk factor for the development of diabetic retinopathy. A large study of patients conducted in the US has shown that increase in blood pressure is associated with increase in occurrence of both mild and severe forms of diabetic retinopathy. A large study of patients conducted in the UK showed that good blood pressure control reduced the risks of progression of diabetic retinopathy by one-third, visual loss by half, and the need for laser treatment by one third in diabetics who relied on oral medicine for control of disease. One type of blood pressure lowering medication such as enalapril can also reduce the progression of all forms of diabetic retinopathy, including serious forms.

Blood Lipid or Cholesterol Control

High blood lipid may contribute to the development of diabetic retinopathy. More severe forms of diabetic retinopathy are associated with increased blood lipid levels. One type of lipid lowering drug, fenofibrate, has been found to reduce the need for laser treatment of diabetic retinopathy.

Treatment of the Eye

Laser Therapy

Laser therapy has been the tried and tested method of treatment of severe forms of diabetic retinopathy. Laser therapy prevents the worsening of diabetic retinopathy and stabilises the vision of patients. There are two types of laser therapy for diabetic retinopathy.

One type of laser therapy is called **pan retinal photocoagulation**, where laser therapy is applied to the entire retina except the macula (central part of the retina). This helps to reduce bleeding and the worsening of diabetic retinopathy.

Another type of laser therapy is called **focal or grid laser** where laser is applied to the macula so as to reduce the swelling in the macula. However, laser destroys the retina and has side effects such as poor adaption to the dark surroundings and decreased side vision.

Injections of Medicine into the Eyeball

The unhealthy retina of the eye produces a substance called vascular endothelial growth factor (VEGF) which causes diabetic retinopathy, resulting in bleeding and central retinal swelling. A few medications such as ranibizumab, bevacizumab and aflibercept can act against the VEGF. They are injected into the eyeball to control the diabetic retinopathy. Their effectiveness and safety have been proven in many large studies of patients. These patients need more regular follow-up appointments, investigations and numerous injections of medications. The medications can be used alone or combined with laser therapy, depending on the form of diabetic retinopathy.

However, injection of medications into the eyeballs is associated with systemic side effects such as uncontrolled hypertension and stroke; and side effects of the eyes such as infection, cataract and retina detachment. Therefore, the medications should be used with caution in patients with diabetes and diabetic retinopathy.

Vitreoretinal Surgery

The vitreous (jelly of the eyeball) occupies the central space of the eyeball. Severe forms of diabetic retinopathy cause bleeding into the jelly and scars can form within the jelly which can pull off the retina, leading to retinal detachment. Vitreoretinal surgery which involves cutting of the jelly to repair the retina has been used effectively for the treatment of prolonged bleeding or retinal detachment within the eyeball. The aim of the surgery is to stabilise the eye and to maintain vision. There has been a marked improvement in the techniques and technology of the equipment used for the surgery, making the operation safer and faster, with faster recovery of patients. However, surgery has its own risks and complications such as infection, severe bleeding and blindness. The risks and benefits of the surgery must be weighed carefully before the patient proceeds to surgery.

Future Directions

There has been a vast improvement in the understanding of development of diabetic retinopathy. More medications are being researched which may be used in future to improve the treatment of diabetic retinopathy and prevent vision loss. Laser treatment is destructive to the retina even though it can treat the eyes with diabetic retinopathy and preserve the vision. Regenerative medicine in the form of stem cell treatment may play a role in reversing the effects of diabetic retinopathy and laser treatment. Nevertheless, despite better treatment options for diabetic retinopathy, screening is still important for early detection of disease while good systemic control of high blood sugar, high blood pressure and blood lipids is still key to preventing the onset and reducing the progression of diabetic retinopathy.