Age-related Macular Degeneration

Description

Age-related macular degeneration (AMD) is a disease of the eye in which the light-sensing cells (photoreceptors) in the central part of the retina (macula) deteriorate, resulting in loss of visual function. The macula contains the fovea, which is the part of the retina that we use for high acuity vision. Consequently, AMD patients tend to develop severely blurred vision and lose the ability to resolve fine detail, making it impossible to read, drive and eventually perform the simplest everyday task. Other visual deficits include difficulties in discerning colours, reduction in visual contrast, distortions to the image and in certain cases complete blindness.

In developed countries, AMD is the leading cause of visual impairment and blindness in older adults, and affects an estimated 30-50 million people worldwide. In Australia, AMD is responsible for half of all blindness cases and affects roughly 1 million people, with a prevalence of nearly 1 in 7 individuals over 50 years of age. In addition to the loss of quality of life for affected persons, AMD represents a major economic burden, with the total cost of associated vision loss estimated at $5 billion annually in Australia alone.

The progression of AMD can be split into 'early' and 'late' stages. Early stage AMD patients may experience no, or only slight, deterioration in their vision; early AMD is usually detected during routine eye examinations and is characterised by the accumulation of whitish-yellow deposits ('drusen') behind the retina, or changes in the degree or pattern of pigmentation of the retinal pigment epithelium.

Late stage AMD patients have some detectable form of visual impairment, which can progress rapidly to severe visual loss and blindness. Late stage AMD can be split into two forms: a more common 'dry' form, also known as central geographic atrophy AMD, and a less common 'wet' form, also known as neovascular or exudative AMD. Both forms of the disease are associated with activation of the body's own immune response in the retina.

Dry AMD is caused by degenerative changes in the photoreceptors, the retinal pigment epithelium and the network of blood capillaries (choriocapillaris) in the choroid that brings oxygen and other nutrients to the retina. Dry AMD usually develops slowly over many years, with gradual loss of visual function. Patients may develop blurred vision or a blind spot in the centre of the visual field; have difficulties in recognising faces, seeing in dim light, reading or close work, and experience a decrease in the apparent brightness of certain colours.

Wet AMD is usually more severe and progresses more rapidly than dry AMD. Thankfully, it is also less common, accounting for only about 10% of all AMD cases. Typically, patients with wet AMD have had the dry form of the disease first, but it is not yet possible to predict with certainty which dry AMD sufferers will go on to develop wet AMD. Wet AMD is characterised by a rapid deterioration in visual function and is caused by the abnormal growth of choroidal blood vessels into the macula (neovascularisation). Fluid, lipids and blood leaking from these blood vessels cause fibrous scarring and interfere with visual function. Patients may experience blurring in the centre of the visual field, a well-defined dark patch or blind spot (scotoma), greatly reduced brightness of colours, and visual distortions (metamorphosia) such as straight lines appearing wavy and vertical objects appearing lopsided.

Risk Factors

The single most important risk factor for AMD is increasing age. Over 10% of people more than 80 years of age have late stage AMD and the risk of developing the disease increases sharply from the age of 65. Other risk factors include long-sightedness (hyperopia), a darkly pigmented iris (the coloured part of the eye surrounding the pupil), gender (more common in women) and ethnicity. Genetics also play a part, with at least 15 different identified genes contributing to some form of AMD, and so your chances of developing AMD are greater if you have a family history of the disease.

Environmental and behavioural factors are also thought to influence the likelihood of developing AMD. Smoking, obesity, a poor diet low in antioxidants, vitamins, zinc and omega-3 fatty acids, and an unhealthy lifestyle or other health factors (high blood pressure, high cholesterol) related to cardiovascular disease and stroke, are all major risk factors for AMD. A genetic predisposition to AMD may be exacerbated by these environmental factors.

Prevention

Smoking, obesity and a lack of physical exercise are important risk factors for AMD and should be avoided to reduce the likelihood of the disease progressing to more advance stages, as well as other health benefits. Other preventative measures include having a diet rich in foods that contain the macular carotenoids lutein and zeaxanthin (dark green leafy vegetables such as spinach, cress and kale), antioxidant vitamins (A, C and E) and minerals (zinc and copper) as well as omega-3 fatty acids (fish).

Treatments

Currently there are no clinical treatments available for the dry form of AMD. However, the progression of dry AMD may be reduced by following the lifestyle and dietary recommendations listed above. New research in animal models suggests that dry AMD may be treated using controlled doses of near-infrared light, but development of this promising potential treatment is still in its early stages.

Wet AMD is primarily treated by drugs that prevent the growth of new blood vessels and include ranibizumab (sold as Lucentis®), bevacizumab (Avastin®), pegaptanib (Macugen®) and aflibercept (VEGF Trap-Eye®). These drugs are usually injected directly into the vitreous, the jelly like substance that fills most of the eyeball and contacts the retina and repeat injections are made either to a schedule or in response to clinical assessment of disease progression. Although in some trials these drugs have stabilised the progression of wet AMD and even caused some improvement in visual function, there are issues with these current treatments. First, the highly invasive nature of the treatment can cause an increased risk of cataracts and infection. Secondly, drugs designed to stop vascular growth/ repair may have unintended side effects on other systems in the body and place patients at a higher risk of cardiovascular disease and stroke.

Research into alternative treatments for AMD is underway. Non-pharmaceutical approaches include gene therapy, where missing or damaged genes are replaced by functional genes delivered to the retina by a harmless viral infection, the regeneration of damaged tissue from embryonic stem cells, and retinal prostheses for severe cases.

Sources and Further Reading

Deloitte Access Economics and Mitchell, P. (2011) “Eyes on the future: a clear look at age-related macular degeneration”. Macular Degeneration Foundation (http://www.mdfoundation.com.au/LatestNews/MDFoundationDeloitteAccessEconomicsReport2011.pdf)

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