Visual Disorders in Middle-Age and Elderly Patients with Diabetic Retinopathy


Shigehiko KITANO

Professor, Department of Ophthalmology, Diabetes Center, Tokyo Women's Medical University

Abstract: The risk of combined diabetic retinopathy is relatively high in elderly diabetic patients. The primary reason for this is that many elderly diabetic patients suffer from physical and mental ailments and often take poor control of their blood sugar, especially in consideration of their social background. Additionally, long-term elderly diabetic patients frequently have an increased incidence of diabetic retinopathy. Generally, the activity level of retinopathy in elderly diabetic patients is low. On the other hand, maintenance of the visual function by ophthalmologic treatment is more difficult in elderly patients than in those who are younger. Therefore, given these characteristics, elderly diabetic patients require a greater degree of ophthalmologic management.

Key words: Diabetic retinopathy; Visual disorder; Elderly patients; Vitreous surgery

Introduction

Visual impairments in the elderly are due to physiological aging phenomena and diseases to which the elderly are susceptible. Among such diseases are senile cataracts and age-related macular degeneration, and diabetic retinopathy is cited along with glaucoma as a disease to which middle-age and elderly patients are susceptible.

A fact-finding study on diabetics conducted by the Japanese Ministry of Health & Welfare in 1997 found the diabetic population of Japan to number around 6.9 million, or 13.7 million if a “reserve population” is included. The breakdown of this group by age shows that about 5% are in their 40s, about 10% are in their 50s, and about 14% are in their 60s, indicating that the percentage increases with age. The males in their 60s account for about 17%, the highest percentage among the entire patient population. This figure means that about half of all diabetics are elderly.

Diabetic retinopathy is one of the complications of chronic diabetes mellitus. Thanks to recent advances in medical management and treatment techniques, the mean life expectancy
of diabetics has been increasing. However, with the extension of the mean life expectancy, an increasing number of elderly patients have developed diabetic retinopathy. It is therefore essential that we study the characteristics of diabetic retinopathy in elderly patients and the care that is required in its management.

**Blood Sugar Control and Duration of Morbidity in Diabetics**

Blood sugar control and the duration of the disease are very much involved in the onset and progress of diabetic retinopathy. In other words, the poorer the control of the blood sugar level and the longer the duration of diabetes, the more likely it is that the patient will develop diabetic retinopathy.

The nine-year Diabetes Control and Complication Trial conducted in the United States clearly showed that strict control of blood sugar significantly restrains the onset and progress of diabetic retinopathy.

It is reported that fasting blood glucose is usually below 140 mg/dl in elderly diabetics, but their blood sugar control is not necessarily easy. This results from diverse physical and mental ailments including heart disease and complications of other diseases. In addition, the level of their daily activities and cognitive abilities are lowered, they have tendencies toward depression, and suffer the risk of hypoglycemia, all of which contribute to somewhat lenient management of their blood sugar control. There are concerns that poor blood sugar control may help develop diabetic retinopathy.

Among elderly diabetic patients, there are naturally those whose duration of morbidity is extended because of the onset of the disease at a young age. At the other end of the spectrum, there are those who are diagnosed as diabetics for the first time after they have reached old age because of lowered glucose tolerance caused by aging. The fact that the onset and progress of diabetic retinopathy are affected by the period of morbidity suggests that the number of elderly patients with diabetic retinopathy is largely dependent on their age at the onset of diabetes mellitus.

When diabetic patients were initially seen at the author’s clinic, they were classified into three groups, those younger than 40, those aged between 40 and 65, and those older than 65. The percentage of diabetic retinopathy was 23% for the young group, 40% for the middle-age group, and 43% for the elderly group (Fig. 1). The older the patient, the greater the tendency for developing diabetic retinopathy.

Since the period of morbidity for elderly diabetic patients is naturally longer than others, the subjects were matched by duration of the disease. In those whose period of morbidity...
was between 6 and 15 years, diabetic retinopathy was significantly lower in the younger group. Among those whose period of morbidity ranged between 16 and 25 years, there was no significant difference between the age categories. In other words, the prevalence of diabetic retinopathy was higher in the older group when all groups were compared, but the influence of the length of morbidity was the apparent cause. When the subjects were matched by duration of morbidity, there were no apparent age-related differences in the prevalence of diabetic retinopathy.

**Characteristics of Diabetic Retinopathy in the Elderly**

Diabetic retinopathy in elderly diabetic patients should be examined by changes attributable to aging in addition to the effects of diabetic microangiopathy. Age-related changes in the choroid and vitreous body are considered to affect the clinical model of diabetic retinopathy.

Elderly patients develop so-called “senile tigroid fundus” in which the retinal reflex is limited, the hue is dark, and the great choroidal vessels are visible. The nerve fiber and ganglion cell layers of the retina become thin, and the number of ganglion cells decreases with aging. Surprisingly, age-related changes in the retina itself are usually minimal and do not affect vision.

Arteriosclerotic changes in the retinal vessels become evident with aging. These changes become even more pronounced if hypertension or diabetes is present. Arteriosclerosis, in turn, promotes the onset and progress of diabetic retinopathy.

Just as there is a blood-brain barrier in the brain, there is a blood-ocular barrier in the eye to prevent an unchecked influx of substances from the blood and to maintain physiological homeostasis. The blood-ocular barrier consists of the blood-aqueous barrier and the blood-retina barrier. Both retinal pigment epithelium and retinal vascular endothelium play important roles as components of the blood-retina barrier. With aging, the hexagonal cell structure in the retinal pigment epithelium disassembled, and the phagocytic capacity of the outer segments of the photoreceptor cells is lost. Bruch’s membrane, between the retinal pigment epithelium and the choroid, becomes thickened with aging.

These changes appear to be involved with the increased permeability of the blood-retina barrier caused by aging. In vitreous fluorophotometry, the increased leakage of fluorescein from retinal vessels to the vitreous body is actually observed with advances in age. Accelerated permeability of the blood-retina barrier possibly affects the morbidity of diabetic retinopathy, particularly that of macular edema, which often accompanies diabetic retinopathy.

Age-related changes in the vitreous body include liquefaction of the gelatinized vitreous body and subsequent posterior vitreous detachment. In patients in their 40s, the incidence of posterior vitreous detachment is reported to be 8%. It is 22% for those in their 50s, 43% for those in their 60s, 71% for those in their 70s, and 85% for those in their 80s. Retinal traction by posterior vitreous detachment is said to affect the progress of diabetic retinopathy in a variety of ways.

If there is a strong adhesion between the retina and the vitreous body, the proliferative membrane of fibrous blood vessels that develops along the posterior vitreous membrane breaks to cause vitreous hemorrhage and tractional retinal detachment due to its contraction. Conversely, there are many cases where the eye that is free of adhesion between the retina and the vitreous body, having almost complete posterior vitreous detachment, works to control and ameliorate diabetic retinopathy. In other words, as the patient gets older, the incidence of posterior vitreous detachment increases and tends to restrain the progress of diabetic retinopathy.
Incidence of Elderly Diabetic Retinopathy Classified by Morbid Stages

For the purposes of comparison, patients with diabetic retinopathy were classified by their stage of morbidity into simple retinopathy, proliferative retinopathy, and quiescent proliferation retinopathy. The incidence of proliferative retinopathy with more severe visual impairment was 16% in the elderly group, 25% in the middle-age group, and 31% in the young group, indicating that the incidence decreases with advanced age (Fig. 2).

Although patients with an extended history of diabetes are considered to be more likely to develop diabetic retinopathy, the ratio of proliferative retinopathy was lower in the elderly group when compared with the younger group by duration of morbidity of either 6 to 15 years or 16 to 25 years. The ratio of those who developed diabetic retinopathy or whose diabetic retinopathy progressed during the observation period was significantly lower in the elderly group: 5% in the elderly group, 14% in the middle-age group, and 23% in the younger group.

The above results suggest that the risk of elderly diabetic patients developing proliferative retinopathy is less than for younger patients. In particular, those patients whose glucose tolerance lessened with aging and whose onset of diabetes mellitus occurred in old age had fewer risks of onset and progress of diabetic retinopathy. No elderly patients developed proliferative retinopathy during the observation period.

Diabetic retinopathy in the elderly is characterized by an extended period of morbidity as a background factor and a higher prevalence, both of which influence onset and progress. In contrast, however, the incidence and ratio of developing proliferative retinopathy are low.

Ophthalmic Treatment of Diabetic Retinopathy in Elderly Patients

Currently, no medicine is considered specific and effective for treating diabetic retinopathy. The presently available treatment consists primarily of photocoagulation of the retina and vitreous surgery.

The efficacy of retinal photocoagulation for diabetic retinopathy has been established in many reports. Its main purpose is to prevent or to arrest the progress of proliferative retino-
A review of effective control of the formation of new vessels by retinal photocoagulation in diabetic retinopathy reveals that the treatment is more than 80% successful if conducted at appropriate times. A review of the effectiveness of retinal photocoagulation in elderly patients according to age did not reveal any difference regarding angiogenesis control. This is because the incidence and ratio of progress to diabetic retinopathy in the elderly are low even though many patients have accelerated vascular permeability that tends to resist retinal photocoagulation. The incidence of macular edema, a complication of retinal photocoagulation, is expected to be high because vascular permeability is promoted in many elderly patients.

Vitreous surgery is performed when a patient with proliferative diabetic retinopathy develops visual impairment caused by vitreous hemorrhage or traction retinal detachment. Because of advances in surgical instruments and techniques in recent years, the performance of vitreous surgery has improved dramatically, contributing to increases in the prevention of blindness by diabetic retinopathy. The success of vitreous surgery for diabetic retinopathy, particularly regarding postoperative vision, is much higher among elderly patients than among younger patients.

Table 1 Results of Vitreous Surgery for Proliferative Retinopathy
Although no difference was observed in the number of patients aged 65 or over for whom vitreous surgery improved vision by more than two steps, significantly few had post-operative vision of 0.5 or higher.

<table>
<thead>
<tr>
<th>Age</th>
<th>Vision improved by more than 2 steps</th>
<th>Post-operative vision is more than 0.5</th>
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<tbody>
<tr>
<td></td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Younger than 65</td>
<td>95</td>
<td>22</td>
</tr>
<tr>
<td>Older than 65</td>
<td>14</td>
<td>2</td>
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$\chi^2$ test $p = 0.539$ $p = 0.031$

detached, the surgery itself is not so difficult. However, since only about half of the patients recover vision of more than 0.1 after the operation and significantly fewer recover vision above 0.5, the results cannot be characterized as excellent when compared to younger patients (Table 1).

This means that while diabetic retinopathy progresses rapidly and its activity level is higher among younger patients, many of these patients retain their macular functions comparatively well, so that once the active lesion is removed by vitreous surgery, the prognosis regarding vision is comparatively good. Conversely, in elderly diabetic patients the macular functions are likely to be poor due to degenerative changes in the retina caused by extended hemorrhage and edema. Therefore, the postoperative quality of vision will be poorer for elderly diabetics although the success ratio of surgery per se may be the same.

The problems faced by elderly diabetics include psychosomatic ones, limitations in blood sugar control because of social background, and higher risk for complications of diabetic retinopathy due to the extended period of morbidity. While the activity level of diabetic retinopathy is generally low among elderly patients, maintaining their visual functions is characteristically difficult, warranting further studies of innovative ophthalmic treatments and indications for surgery by considering these characteristics.
REFERENCES


