The second eye of Japanese patients with unilateral exudative age related macular degeneration

Masanobu Uyama, Kanji Takahashi, Noriko Ida, Miki Miyashiro, Akira Ando, Atsushi Takahashi, Eri Yamada, Junya Shirasu, Yoshimi Nagai, Masamitsu Takeuchi

Abstract

**Aim**—To clarify the incidence of choroidal neovascularisation (CNV) and predisposing findings for development of CNV in the second eye of Japanese patients with unilateral exudative age related macular degeneration (AMD).

**Methods**—The second eyes of unilaterally affected patients with exudative (neovascular) AMD treated in our clinic during the past 10 years (1988–97) were carefully followed up for more than a year. Evidence of CNV was confirmed by fluorescein and indocyanine green angiography. Macular lesions in patients, in whom CNV developed in the second eye, were retrospectively evaluated from patient records.

**Results**—170 patients met the criteria. The average follow up period was 47 months (range 12–108 months). All patients were Japanese. CNV developed in the second eye in 12% of patients, 30.3 months on average after the first examination. Cumulative incidence of developing CNV in the second eye using Kaplan–Meier life table analysis was: 0.6% by 1 year, 5.6% by 3 years, and 12.3% by 5 years, and was relatively low compared with that in white patients. CNV developed most frequently from serous pigment epithelial detachment (PED) in the macula (58%). Soft drusen were not prevalent and risk of developing CNV was not very high (18%).

**Conclusion**—It was confirmed that there were some differences in the incidence and predisposing findings for CNV developing in AMD among Japanese and other Asian patients compared with those in white people. It is important to recognise these differences between the two populations to understand the pathogenesis and epidemiology of AMD.

Exudative (neovascular) age related macular degeneration (AMD) is a leading cause of blindness in elderly people in Western countries. Although, in Japanese as well as in other Asian people, the number of patients with exudative AMD is not as great as in Western countries, the number of patients has been rapidly increasing recently and is now becoming one of the major causes of blindness in the elderly. Epidemiology and clinical features of exudative AMD have been well established in the United States and United Kingdom. In Japan, clinical manifestations of AMD have become clearer during the past 20 years.

Following the increase in patients with AMD, we have recognised that Japanese patients show some differences from white patients with regard to epidemiological features and predisposing findings for the development of choroidal neovascularisation (CNV).

In white people, soft drusen at the macula prevalent among elderly people, are commonly present in AMD, and these people show the highest risk for developing CNV. In Japanese people, however, soft drusen are not as commonly seen among elderly people, or among patients with AMD but, rather, serous retinal pigment epithelial detachments (PED) are the most frequent predisposing lesions for developing CNV. These findings were also similar to those in other Asian patients.

Many papers have reported a very high annual incidence of CNV in the second eye in exudative AMD among Western patients. We, however, have noted that in Japanese and Asian patients the incidence is not as high. It is important to confirm these differences between the two groups, to understand the aetiology and pathogenesis of AMD. Our clinic is one of the leading centres for AMD and macular diseases in Japan, many patients with early and late AMD are referred to us, and we have collected a large series of AMD patients. We attempted to evaluate macular lesions and the development of CNV in the second eyes of Japanese patients with unilateral exudative AMD.

**Patients and methods**

The second eyes of unilaterally affected patients with exudative (neovascular) AMD were followed up in our clinic for the last 10 years (from 1988 to 1997), and were carefully examined by one of the two authors who are experienced specialists (MU or KT). Routine ophthalmological examination, direct and indirect binocular ophthalmoscopy, slit lamp biomicroscopy with a contact lens, fluorescein fundus angiography, and indocyanine green (ICG) angiography were performed in all patients. Macular manifestations were retrospectively reviewed from patient records. The patients were regularly followed up at 1–3 month intervals, and whenever a patient presented with any new symptom.

Using procedures described above, it was confirmed that the second eye did not show any evidence of CNV at the first examination. Dur-
ing the follow up period development of CNV in the second eye was confirmed by fluorescein angiography and/or ICG angiography, when findings in the macula showed any sign of CNV (haemorrhage, exudation, or elevation).

INCLUSION CRITERIA FOR EXUDATIVE AMD IN THIS SERIES

Patients were more than 50 years of age. The macula showed serous and/or haemorrhagic retinal detachment, with or without serous and/or haemorrhagic retinal pigment epithelial detachments (PEDs), subretinal fibrinous exudations with subretinal fibrovascular membrane, or subretinal fibrous scarring in the macula. Fluorescein and/or ICG angiography clearly demonstrated evidence of CNV, both classic and occult types, in the macula. CNV was confirmed as the following standard with fluorescein angiography:

**Classic CNV**—In the early phase, lacy hyperfluorescence with a well demarcated margin, and in the late phase progressive leakage from them.

**Occult CNV**—Ill defined early hyperfluorescence and late leakage. On ICG angiography, early network of hyperfluorescence and late subretinal staining were demonstrated.

Exclusion criteria were patients with other causes of exudative maculopathy such as angioid streaks, high myopia, presumed ocular histoplasmosis syndrome, idiopathic polyoid choroidal vasculopathy, and central serous chorioretinopathy, follow up period less than 1 year, lack of regular follow up, and incomplete patient records.

Macular manifestations, such as hard drusen, soft drusen, serous and haemorrhagic PED, and retinal pigment epithelium (RPE) abnormality (pigmentary degeneration, RPE atrophy and degeneration) were defined according to the international classification and grading as follows. Hard drusen are small, round, sharply margined, and yellowish white deposits at the level of RPE. Soft drusen are large, fuzzy bordered, solid, thick in appearance, and yellowish white deposits at the level of RPE. Soft drusen are large, fuzzy bordered, solid, thick in appearance, and yellowish grey deposits at the deep retina. Some are confluent and dome-shaped.

**Pigment epithelial detachment (PED)**—Serous PED is round or oval, yellow or yellow brown, sharply demarcated mound of elevated RPE, without evidence of CNV on angiography. Haemorrhagic PED contains bleeding from CNV, showing a hyphaema-like horizontal line and a dark elevated mound under the retina.

**RPE abnormalities**—RPE at the macula shows brownish degeneration, or an atrophic appearance, or a small area of mottled pigmentation, hyperpigmentation, or hypopigmentation.
Results
During the last 10 years, 170 patients with unilateral exudative AMD met the criteria described above. The average follow up period was 42 months, ranging from 12 to 108 months. There were 110 men (65%) and 60 women (35%). The average age of these patients was 67 years of age, ranging from 44 to 87, at the first examination. All patients were Japanese.

Macular lesions of the affected eyes of 170 patients at the first examination were as follows. The most frequently seen finding in the involved eyes was serous neurosensory retinal detachment with a small nodular yellowish-white lesion (fibrovascular membrane) at the macula associated with tiny subretinal haemorrhage (Fig 1). These findings were seen in 81 eyes (48%).

Secondly, large dense subretinal and/or sub-pigment epithelial haemorrhages were seen at the macula in 36 eyes (21%) (Fig 2). Massive subretinal fibrinous exudation with subretinal haemorrhage and serous retinal detachment, which is a typical manifestation of exudative AMD and described as a disciform lesion, were seen in 30 eyes (18%) (Fig 3). Subretinal fibrous scarring was seen in two eyes (1%) (Fig 4). Large serous and/or haemorrhagic PEDs associated with serous retinal detachment were seen in 22 eyes (13%) (Fig 5A–D).

Macular lesions of the second eye at the first examination (baseline) are shown in Table 1. The most frequently seen finding was RPE abnormalities in 52 eyes (30%) (Fig 6). Soft drusens were seen in only 11 eyes (6%) (Figs 7, 8). Large subretinal haemorrhage was seen in 30 eyes (18%) (Fig 9). Massive subretinal fibrinous exudation with subretinal fibrovascular membrane was seen in 22 eyes (13%) (Fig 10A–D).
Serous PEDs were seen in eight (5%) (Fig 10). Half of the eyes (49%) showed no abnormality in the macula.

During the follow up period, CNV, newly developed in the second eye, was seen in 12 (7%) of 170 eyes, at an average of 30.3 months (12–59 months), after the first examination (Table 2). The patient age in these 12 cases was 70.8 years on average, ranging from 58 to 82. There were eight men and four women. The cumulative incidence of the development of CNVs was estimated using the Kaplan–Meier life table analysis. Cumulative incidence of developing CNV in the second eye was 0.6% at 1 year, 5.6% at 3 years, and 12.3% at 5 years (Fig 11).

Macular lesions from which CNV developed in the second eye of these 12 patients are shown in Table 3. In these 12 eyes, the most frequently seen predisposing manifestation was serous PED, which was seen in seven eyes (58%) (Fig 10). The size of PED in which CNV developed varied from 0.3 disc diameter (DD) to 1.5 DD, and was 0.6 DD on average. Of these seven eyes with serous PED it was pre-existing at the first examination in one eye. Among the other six eyes, serous PED developed from soft drusen in one eye, from hard drusen in two eyes, from RPE abnormalities in two eyes, and there was no macular abnormality at the first examination in one eye. These serous PEDs in which CNV developed spontaneously and suddenly appeared from various manifestations at the macula. Thereafter, CNV usually developed in a short period within or adjacent to the serous PEDs.

CNV developed from soft drusen in two eyes (18%) (Fig 8). In these two eyes, many large soft drusen were present at the first examination (Fig 9); thereafter CNV developed within these lesions. CNV developed from RPE abnormalities in three eyes (25%) (Fig 6), (Table 3).

After developing CNV, most eyes showed serous detachment of the neurosensory retina in the macula with a small fibrovascular membrane (Fig 1), and the remaining eyes had subretinal haemorrhage (Fig 2), or serous PED associated with serous retinal detachment and fibrovascular membrane (Fig 5A–D).

Discussion

The incidence of CNV in the second eye of white patients with unilateral exudative AMD was reported to be high. Many studies reported the incidence of developing CNV in the second eye were 12–15% per year,10 5–10% per year,7 3–15% per year13; the cumulative incidence of developing CNV was estimated as 13% at 1 year, 22% at 2 years, and 29% at 3 years14; 3% at 1 year, 10% at 2 years, and 20% at 3 years15; 4% at 1 year, 10% at 2 years, and 17% at 3 years.16 These were retrospective studies.
Table 2  Patients developing CNV in the second eye

<table>
<thead>
<tr>
<th>Patient No</th>
<th>Age/sex</th>
<th>Interval (months) until developing CNV after first examination</th>
<th>Macular lesion from which CNV developed</th>
<th>Size of PED (DB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>82 M</td>
<td>12.0</td>
<td>soft drusen</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>72 F</td>
<td>13.5</td>
<td>soft drusen</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>82 F</td>
<td>17.7</td>
<td>soft drusen</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>79 M</td>
<td>20.0</td>
<td>RPE abnormality</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>59 M</td>
<td>21.6</td>
<td>RPE abnormality</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>76 M</td>
<td>26.0</td>
<td>serous PED</td>
<td>0.6</td>
</tr>
<tr>
<td>7</td>
<td>62 M</td>
<td>27.1</td>
<td>serous PED</td>
<td>0.3</td>
</tr>
<tr>
<td>8</td>
<td>66 M</td>
<td>29.8</td>
<td>RPE abnormality</td>
<td>0.5</td>
</tr>
<tr>
<td>9</td>
<td>81 M</td>
<td>42.0</td>
<td>RPE abnormality</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>70 M</td>
<td>44.5</td>
<td>serous PED</td>
<td>0.4</td>
</tr>
<tr>
<td>11</td>
<td>58 F</td>
<td>51.0</td>
<td>serous PED</td>
<td>0.3</td>
</tr>
<tr>
<td>12</td>
<td>62 F</td>
<td>58.8</td>
<td>serous PED</td>
<td>0.5</td>
</tr>
<tr>
<td>mean</td>
<td>70.8</td>
<td>30.3</td>
<td></td>
<td>0.6</td>
</tr>
</tbody>
</table>

CNV = choroidal neovascularism.
RPE = retinal pigment epithelium.
PED = pigment epithelial detachment.

Prospective studies estimated the incidence was 6% per year,15 and 8.8% each year.16 Moreover, the MPS report17 mentioned four independent risk factors for developing CNV—focal hyperpigmentation, large drusen, multiple drusen, and systemic hypertension. CNV developed in 35% within 5 years with the cumulative incidence of 10%, 28%, and 42% at 1, 3, and 5 years, respectively. A recent population based study (Beaver Dam Eye Study18) reported 0.6% in intact eyes for a 5 years interval after the first examination. Our result indicated the incidence of CNV from RPE abnormalities was 25% and at the second rank of predisposing findings in Japanese patients. Serous PED was the highest risk (58%) for developing CNV in Japanese patients, and CNV developed from any size of serous PED.28 Gass1 and Teeters and Bird1 described serous PED in the elderly as a predisposing finding for developing CNV. Meredith et al24 reported that in 50 eyes with serous PED, 14 eyes (28%) developed CNV at an average of 22 months of follow up, and there was greater risk in eyes with serous PED larger than 1.0 disc diameters and in patients older than 55 years. Braunstein and Gass,25 Casswell et al,26 Elman et al,27 and Poliner et al28 confirmed a similar risk in serous PED. Maguire29 described the incidence of CNV in patients presenting with only serous PED was estimated to be approximately 40%–50% at 3 years.

Yuzawa et al30 reported that serous PED showed a great risk for developing CNV (30%) and a much higher risk than that of soft drusen (4.8%) in Japanese. Lim et al31 recently reported on symptomatic patients with AMD and found a high percentage of serous PED in Asian patients.

In Japanese and Asian patients with unilateral exudative AMD the incidence of developing CNV in the second eye was relatively low. The predisposing finding indicating the great-
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