Intravitreal ranibizumab for neovascular age-related macular degeneration patients with good baseline visual acuity and the predictive factors for visual outcomes

Traitement par ranibuzumab intravitréen chez des patients présentant une dégénérescence maculaire néovasculaire liée à l’âge avec une bonne acuité visuelle initiale et les facteurs prédictifs des résultats visuels

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KEYWORDS
Age-related macular degeneration; Intravitreal injection; Ranibizumab; Retinal pigment

Summary
Purpose. — To evaluate the efficacy of intravitreal ranibizumab for the treatment of neovascular age-related macular degeneration (nAMD) patients with a visual acuity (VA) of ≥ 20/40 and to investigate the predictive factors for visual outcomes.
Methods. — The present study is a retrospective analysis of patients with VA ≥ 20/40. Injections were given monthly for the first 3 months and thereafter as needed. The patients were divided into two groups; group 1, patients not receiving further injections beyond the 3 loading
Introduction

Neovascular age-related macular degeneration (nAMD) is a leading cause of visual loss among elderly population [1,2]. Before the introduction of intravitreal anti-vascular endothelial growth factor (anti-VEGF) therapy for nAMD, only prevention for visual loss might have been achieved in a limited number of patients with different treatment options like laser photocoagulation, radiotherapy, photodynamic therapy, and vitreoretinal surgery [3–9]. Intravitreal treatment with bevacizumab (full length antibody against VEGF-A) and ranibizumab (Fab part of antibody against VEGF-A) have led the vast majority of the patients to prevent the baseline visual acuity (VA), and to achieve visual improvement in up to one third of the patients [10,11]. The pivotal multicenter studies with ranibizumab, like MARINA, ANCHOR, PRONTO, EXCITE, and the comparative study of ranibizumab and bevacizumab, the CATT study, showed that ranibizumab and bevacizumab were effective to prevent VA loss up to 95% of the patients, and is effective to make an improvement in VA up to 40% of the patients [11–15]. However, only the patients with a VA between 20/40 and 20/320 were included in these efficacy studies, and the patients with better VA levels were not evaluated. Lately, some studies evaluating the efficacy of as-needed intravitreal ranibizumab and bevacizumab treatment were reported in this group of patients [16–21]. However, these studies were mainly focused on visual and anatomical outcomes, except one of them [19]. So far, the prognostic factors of final VA for the nAMD patients with good VA were not evaluated yet. In this study, we aimed to evaluate the efficacy of as-needed intravitreal ranibizumab (IVR) in nAMD patients with a VA ≥ 20/40 and the predictive factors for visual outcomes.
Materials and methods

In this retrospective, interventional, case series, we reviewed the records of the nAMD patients who had a baseline of VA ≥ 20/40 and treated with IVR on an as-needed treatment regimen between January 2010 and January 2011 in Beyoğlu Eye Hospital. Institutional review board approval was obtained, and the study adhered to the tenets of the Declaration of Helsinki. A written informed consent was obtained from all patients before the treatment.

To be included in the study, each patient was required to have all of the following criteria; age ≥ 50 years, best corrected VA (BCVA) ≥ 20/40, to be newly diagnosed as treatment naïve nAMD, and a minimum follow-up time of 12 months. Patients were not included in the study if they had a retinal disease other than nAMD (e.g., diabetic retinopathy, retinal vein occlusion), or if they had received previous intravitreal injection, or photodynamic therapy, or if they had diagnosed as polypoidal choroidal vasculopathy (PCV), or retinal angiomatous proliferation.

Data collected from the patients’ records included age, gender, type of choroidal neovascularization (CNV) (predominantly classic or minimal classic/occult), greatest lesion diameter (GLD) of CNV, the presence of pigment epithelial detachment at the baseline, BCVA and central retinal thickness (CRT) at the baseline, and at month 3, month 6, month 9, and month 12. Also, total number of injections at month 12 was recorded.

All patients underwent a standardized examination including measurement of BCVA via the Early Treatment Diabetic Retinopathy Study (ETDRS) chart at 4m, slit-lamp biomicroscopy and fundus examination, measurement of intraocular pressure (IOP) via applanation tonometry. Fundus photography, fluorescein angiography (FA) (HRA-2; Heidelberg Engineering, Heidelberg, Germany), and optical coherence tomography (OCT) imaging (Stratus OCT TM; Carl Zeiss Meditec Inc., Dublin, CA, USA) were performed before treatment. All examinations were repeated monthly, except FA. Fluorescein angiography was repeated only when the cause of VA deterioration could not be clarified with the clinical examination and other imaging methods. Optical coherence tomography was used for detecting subretinal fluid and measurement of CRT. Central retinal thickness, defined as the mean thickness of the neurosensory retina in the central 1 mm diameter area, was computed using OCT mapping software generated by the device. The GLD of the CNV was defined as disc diameters (DD) and measured with the fundus camera with the built in software. The patients who had a CNV with a GLD of < 1500 μ were defined as having a CNV < 1DD, the patients who had a CNV with a GLD between 1500 μ and 3000 μ were defined as having a CNV of 1–2 DD. In case of suspicion of PCV, or RAP in patients with occult/minimally classic CNV, infracyanine green angiography was obtained. And the patients who were diagnosed to have PCV, or RAP were excluded from the study.

All injections were performed under sterile conditions after topical anesthesia and 10% povidone-iodine (Beta- dine; Purdue Pharma, Stamford, CT, USA) scrub was used on the lids and lashes, and then 5% povidone-iodine was administered on the conjunctival sac. Intravitreal ranibizumab (Lucentis; Novartis, Basel, Switzerland) was injected through the pars plana at 3.5 to 4 mm posterior to the limbus with a 27-gauge needle. After the injection, an ophthalmic solution of 0.5% moxifloxacin (Vigamox; Alcon Laboratories, Inc., Fort Worth, Texas, USA) was administered 5 times a day for one week. Patients were then instructed to consult the hospital if they experienced decreased vision, eye pain, or any new symptoms.

All patients received three loading doses of monthly IVR injections (0.5 mg/0.05 ml) initially. Then the patients were followed monthly. A single injection of IVR was repeated when the VA decreased by one or more ETDRS lines from the last visit, or newly developed macular hemorrhage, or evidence of subretinal fluid on OCT.

First, the patients were divided into two groups, according to the need of reinjection after the three loading doses, the group 1 consisted of patients who did not need further reinjection, and the group 2 consisted of patients who needed further reinjection. Then the second group was divided into two subgroups, group A consisted of patients who received reinjection for subretinal fluid in the macula on OCT, and/or new hemorrhage, and/or persistent leakage from the CNV on FA, but who did not experience VA loss as a retreatment criterion at any follow-up visits. Group B consisted of patients who experienced VA loss with, or without having the other reinjection criteria.

Primary outcome measures in this study included ETDRS BCVA levels, OCT defined CRT measurements, the change in BCVA levels, and CRT levels between the baseline and month 3, 6, 9, and 12. Secondary outcome measures were the mean number of injections at month 12, and the factors that may affect the visual acuity change.

Statistical analysis

Visual acuity was converted to logarithm of Minimum Angle of Resolution (LogMAR) for statistical analysis. The mean changes in VA and CRT over time were analyzed with Wilcoxon test. Fisher’s exact test was used to compare nominal parameters between groups, and Mann-Whitney U test was used for continuous parameters. Pearson or Spearman correlation was used to find association between continuous data. The statistical analysis was performed using SPSS version (Version 15.0, SPSS Inc., Chicago, IL, USA). A P-value of less than 0.05 was considered to be statistically significant.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>General characteristics of the patients.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient number</td>
<td>96</td>
</tr>
<tr>
<td>Mean age ± SD, years (range)</td>
<td>73.9 ± 8.9 (59–86)</td>
</tr>
<tr>
<td>Female/male</td>
<td>42/54</td>
</tr>
<tr>
<td>Right/left eye</td>
<td>44/52</td>
</tr>
<tr>
<td>Phakic/pseudophakic</td>
<td>56/40</td>
</tr>
<tr>
<td>Classic/occult and minimally classic CNV</td>
<td>22/74</td>
</tr>
<tr>
<td>Size of CNV &lt; 1 DD/1–2 DD</td>
<td>57/39</td>
</tr>
</tbody>
</table>

F: female; M: male; R: right eye; L: left eye; CNV: choroidal neovascularization; O: occult; C: classic; GLD: greatest linear dimension; DD, disc diameter; P, P-value.
Table 2 The overall mean visual acuity and central retinal thickness levels at different time points.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Baseline</th>
<th>Month 3</th>
<th>Month 6</th>
<th>Month 9</th>
<th>Month 12</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCVA, LogMAR</td>
<td>0.24 ± 0.07</td>
<td>0.19 ± 0.10</td>
<td>0.23 ± 0.16</td>
<td>0.25 ± 0.18</td>
<td>0.23 ± 0.15</td>
</tr>
<tr>
<td>(range)</td>
<td>(0.1—0.3)</td>
<td>(0—0.5)</td>
<td>(0—1.0)</td>
<td>(0—1.0)</td>
<td>(0—1.0)</td>
</tr>
<tr>
<td>P-value</td>
<td>−</td>
<td>&lt; 0.0001</td>
<td>0.44</td>
<td>0.74</td>
<td>0.67</td>
</tr>
<tr>
<td>CRT, μ (range)</td>
<td>290 ± 81</td>
<td>224 ± 70</td>
<td>226 ± 68</td>
<td>229 ± 67</td>
<td>231 ± 71</td>
</tr>
<tr>
<td>(148—518)</td>
<td></td>
<td>(133—487)</td>
<td>(121—552)</td>
<td>(130—487)</td>
<td>(134—537)</td>
</tr>
<tr>
<td>P-value</td>
<td>−</td>
<td>&lt; 0.001</td>
<td>&lt; 0.001</td>
<td>&lt; 0.001</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

BCVA, best corrected visual acuity; CRT, central retinal thickness, LogMAR, logarithm of the minimal angle of resolution; μ, micrometer.

Results

Ninety-six patients met the inclusion criteria for the study. Choroidal neovascularization was located subfoveally in all of the patients. The general characteristics of the patients are summarized in Table 1.

The overall mean BCVA and CRT values are summarized in Table 2. A significant difference was found between the mean BCVA at the baseline and month 3 (P < 0.0001); however, there was not a significant difference between the mean BCVA at the baseline and month 6, 9, and 12 (P = 0.44, P = 0.74, P = 0.67, respectively). The mean CRT at month 3, month 6, month 9, and month 12 was statistically different from the baseline (P < 0.001, P < 0.001, P < 0.001, P < 0.001, respectively).

Five patients (5.2%) had VA loss of ≥3 lines, and ninety-one patients (94.8%) had stable or improved vision (loss of <3 line, or remained stable, or gained ≥1 lines) at month 12. Thirty-nine patients (40.6%) gained VA ≥1 line; only 4 patients (4.2%) gained VA ≥3 lines.

Best-corrected visual acuity change showed a significant inverse correlation with total number of injections up to month 12 (r = −0.34, P = 0.001), and presence of PED at the baseline (r = −0.35, P < 0.01). No correlation was found between the BCVA change and lesion type (r = −0.03, P = 0.72), or with baseline lesion size (r = −0.14, P = 0.15).

Table 3 shows the injection numbers at month 12 and reinjection indications after the three loading doses until month 12. The mean number of injections was 4.4 ± 1.2 (range 3—7) at month 12.

Twenty-seven patients (28.1%) did not require additional injections after the 3 loading injections (Group 1), whereas 69 patients (71.9%) received further reinjection (Group 2). Baseline characteristics in terms of age and lesion type, lesion size did not show any difference between these subgroup of patients (P = 0.38, P = 0.66, and P = 0.65, respectively). However, 3 of 27 patients (11.1%) in group one had PED at the baseline, in contrast to the 29 of 69 patients (42.0%) in group 2 (P = 0.004).

The mean BCVA of the patients in group 1 at the baseline, month 3, 6, 9, and 12 was 0.29 ± 0.02 LogMAR (range 0.2–0.3 LogMAR), 0.18 ± 0.10 LogMAR (range 0–0.5 LogMAR), 0.17 ± 0.14 LogMAR (range 0–0.6 LogMAR), 0.17 ± 0.12 LogMAR (range 0–0.5 LogMAR) and 0.17 ± 0.11 (range 0–0.4 LogMAR), respectively. The mean BCVA of the patients in group 2 at the baseline, month 3, 6, 9, and 12 was 0.22 ± 0.07 LogMAR (range 0.1–0.3 LogMAR), 0.20 ± 0.1 LogMAR (range 0–0.5 LogMAR), 0.25 ± 0.17 LogMAR (range 0.1–1.0 LogMAR), 0.27 ± 0.19 LogMAR (range 0.1–1.0 LogMAR), and 0.26 ± 0.16 (range 0.1–1.0 LogMAR), respectively (Fig. 1). The change in mean BCVA from the baseline to month 3, 6, 9, and 12 was statistically different between the two groups (P < 0.001 for all).

At month 12, none of the patients in group 1 and five patients (7.2%) in group 2 had VA loss of ≥3 lines (P = 0.15). Twenty-seven patients (100%) in group 1 and 64 patients (92.7%) in group 2 had stable or improved vision (loss of <3 line, or remained stable, or gained ≥1 lines) (P = 0.5). Twenty patients (74.0%) in group 1 and 19 patients (27.5%) in group 2 gained VA ≥1 line (P < 0.01). Four of the patients

Table 3 Number of injections according to the re-injection indications at month 12.

| Number of total injection | 429 |
| Number of initial loading dose | 288 |
| Number of re-injection | 141 |
| Subretinal fluid | 100 |
| Visual acuity loss | 10 |
| Subretinal fluid and visual acuity loss | 18 |
| Hemorrhage | 6 |
| Subretinal fluid and hemorrhage | 7 |

Figure 1. The changes in mean visual acuity in group 1 and group 2. The graph shows the mean LogMAR visual acuity levels from baseline to month 12. The change in mean BCVA from the baseline to month 3, 6, 9, and 12 was statistically different between the two groups (P < 0.001, P < 0.001, P < 0.001, respectively, Mann-Whitney U test). *P < 0.001.
(14.8%) in group 1 and none of the patients in group 2 gained VA ≥ 3 lines (P = 0.001).

The mean CRT of the patients in group 1 at the baseline, and at month 3, 6, 9, and 12 was 285±73 μm (range 148—403 μm), 207±41 μm (range 133—279 μm), 203±48 μm (range 121—294 μm), 210±53 μm (range 130—288 μm) and 199±40 (range 134—274 μm), respectively. The mean CRT of the patients in group 2 at the baseline, and at month 3, 6, 9, and 12 was 292±84 (range 155—518 μm), 230±77 μm (range 149—487 μm), 236±73 μm (range 144—552 μm), 237±70 μm (range 149—487 μm) and 243±77 (range 143—537 μm), respectively (Fig. 2). The change in mean CRT from the baseline to month 3, 6, 9, and 12 months was not statistically different between the two groups (P = 0.13, P = 0.09, P = 0.26, and P = 0.06 respectively).

Among the 69 patients who received reinjection, 48 (69.6%) of patients (Group 2A) did not experience VA loss of ≥ 1 line at any time of the follow-up period as a retreatment criterion, whereas 21 (30.4%) of patients (Group 2B) experienced a VA loss of ≥ 1 line as a retreatment criterion. Baseline characteristics in terms of age and lesion type, lesion size, and the presence of PED did not show any difference between this subgroup of patients (P = 0.66, P = 0.64, P = 0.96, and P = 0.25 respectively).

The mean BCVA of the patients in group 2A at the baseline, and at month 3, 6, 9, and 12 was 0.22±0.06 LogMAR (range 0.1—0.3 LogMAR), 0.19±0.06 LogMAR (range 0.1—0.3 LogMAR), 0.19±0.07 LogMAR (range 0.1—0.5 LogMAR), 0.20±0.08 LogMAR (range 0.1—0.5 LogMAR) and 0.20±0.08 (range 0.1—0.4 LogMAR), respectively. The mean BCVA of the patients in group 2B at the baseline, and at month 3, 6, 9, and 12 was 0.22±0.08 LogMAR (range 0.1—0.3 LogMAR), 0.22±0.16 LogMAR (range 0—0.5 LogMAR), 0.38±0.25 LogMAR (range 0.1—1.0 LogMAR), 0.45±0.24 LogMAR (range 0.1—1.0 LogMAR), and 0.40±0.16 (range 0.1—1.0 LogMAR), respectively (Fig. 3). The change in mean BCVA from the baseline to month 3 was not statistically different between the two groups (P = 0.26); however, the change in mean BCVA at 6, 9, and 12 months was statistically different (P = 0.001, P < 0.001, P < 0.001, respectively).

At month 12, none of the patients in group 2A and five patients (23.8%) in group 2B had VA loss of ≥ 3 lines (P < 0.001). Forty-eight patients (100%) in group 2A and 16 patients (76.2%) in group 2B had stable or improved vision (loss of < 3 line, or remained stable, or gained ≥ 1 lines) (P = 0.25). Sixteen patients (33.3%) in group 2A and 3 patients (14.2%) in group 2B gained VA ≥ 1 line (P = 0.1).

None of the patients in group 2A and none of the patients in group 2B gained VA ≥ 3 lines.

The mean CRT of the patients in group 2A at the baseline, and at month 3, 6, 9, and 12 was 287±72 μm (range 155—414 μm), 223±68 μm (range 149—468 μm), 224±50 μm (range 153—413 μm), 226±58 μm (range 149—430 μm) and 222±54 (range 143—407 μm), respectively. The mean CRT of the patients in group 2B at the baseline, and at month 3, 6, 9, and 12 was 303±109 (range 159—518 μm), 246±96 μm (range 161—487 μm), 264±105 μm (range 144—552 μm), 260±91 μm (range 168—487 μm) and 292±98 (range 175—537 μm), respectively.

The changes in mean central retinal thickness in group 2A and group 2B. The graph shows the mean central retinal thickness levels from baseline to month 12. The change in mean CRT from the baseline to month 3 was not statistically different between the two groups (P = 0.26, Mann-Whitney U test); however, the changes at 6, 9, and 12 months was statistically different (P = 0.001, P < 0.001, respectively, Mann-Whitney U test). *P < 0.001.
respectively (Fig. 4). The change in mean CRT from the baseline to month 3, 6, 9, and 12 months was not statistically different between the two groups (P = 0.35, P = 0.63, P = 0.41, P = 0.06 respectively).

The total number of injections at month 12 was 4.9 ± 1.0 (range 4–7) in the group 2A and 5.2 ± 1.0 (range 4–7) in the group 2B, the difference was not statistically significant (P = 0.41).

The mean baseline intraocular pressure was 15.3 ± 1.9 mmHg (range 11–19 mmHg), and IOP at month 12 was 15.9 ± 1.9 mmHg (range 12–20 mmHg) (P = 0.07). After a total of 425 injections, no serious complications like endophthalmitis, vitreous hemorrhage, and retinal detachment were observed in any of the patients. Only mild complications like punctate keratitis (12.5%), subconjunctival hemorrhage (8.3%), and transient mild anterior uveitis (4.1%) was detected.

**Discussion**

In this study, intravitreal ranibizumab on an as-needed treatment regimen was found to be effective in preventing visual loss and improving the macular anatomy in nAMD patients with a VA of ≥ 20/40. In addition, the presence of PED at the baseline was a negative predictive factor for the final visual acuity outcome, and was a predictor of the further reinjection requirement. VA loss during the follow-up period was a negative prognostic factor for the final visual outcome. The age, type of CNV, and size of CNV was not associated with the final visual outcome.

Takahashi et al. [16], reported that bevacizumab on an as-needed treatment regimen was effective in preserving the VA in nAMD patients (n = 15) with a Snellen VA of 0.6 or better. After a mean follow-up time of 17.4 months, VA decreased from 0.89 to 0.79 Snellen equivalent, but the difference was not statistically significant. The patients were treated with only one initial injection, and then received additional injections, and the mean injection number was reported as 1.85. This was not similar to our study, in which the mean VA was nearly stable. This difference may be associated with the initial treatment regimen, because Takahashi et al., started the treatment with only one injection; however, in most of the anti-VEGF studies like ANCHOR and MARINA; it is shown that the VA rapidly increases with the initial three monthly injections, then it remains stable with the following injections [11,12].

Axer-Siegel et al. [17], evaluated the efficacy of intravitreal bevacizumab on the visual and anatomical outcomes of the patients with nAMD with a VA of 20/40 or better. The study included 150 eyes of 130 patients and all the patients received 3 loading doses of intravitreal bevacizumab every 6 weeks and the treatment was repeated when fluid or retinal hemorrhage was present. VA loss was not a treatment criterion for this study. After a follow-up time of 20.2 months, the mean BCVA remained stable; it was 0.22 LogMAR at the baseline, and 0.22 LogMAR at the last follow-up visit. The mean baseline CRT was 267 μ, and decreased to 226 μ at the last follow-up visit. In addition, 7.3% of the eyes lost ≥ 3 lines of VA, 70.7% eyes had stable or improved VA. The mean number of injections was 11.3 for the overall follow-up period, and 6.6 injections for the first year. The visual and anatomical outcomes of our study were similar to this study. The mean VA was stable and there was a significant decrease in the mean CRT, in both studies. Although VA loss was not accepted as retreatment criteria in the study by Axer-Siegel et al. [17], the mean injection number at month 12 was greater than our study. This may be due to the difference of retreatment criteria; in our study subretinal fluid was defined as a retreatment criterion, whereas in the study by Axer-Siegel et al. [17], any kind of fluid was defined as a retreatment criterion.

In a case control study about the efficacy of IVR for nAMD patients with a VA ≥ 20/40 by Saito et al. [18], patients initially received 3 monthly IVR injections, which were followed by an as-needed treatment regimen. Retreatment criteria were similar to PRONTO study [13]. Twenty-two nAMD patients were included in the treatment group. After a follow-up time of 12 months, the mean VA improved from 0.17 to 0.07 LogMAR, the mean CRT decreased from 276 μ to 179 μ, and the mean number of injections was 4.6. In the control group, 19 nAMD patients and 33 PCV patients were included. The mean BCVA of nAMD patients decreased from 0.08 to 0.18 LogMAR at month 12, the mean BCVA of the PCV patients decreased from 0.10 to 0.23 LogMAR, and the differences between study and control groups were found to be statistically significant. As the retreatment criteria were similar in our study and this study, the visual and anatomic outcomes were similar, too; and the mean injection numbers were very close (4.6 versus 4.4).

Baba et al. [19], Mones et al. [20], Raja et al. [21], and Williams and Blyth [22] reported similar results in nAMD patients with a baseline VA of ≥ 20/40, on an as-needed ranibizumab or bevacizumab treatment. Baba et al. [19], evaluated the nAMD patients who had PED in the baseline in three groups; avascular PED, PCV, and occult CNV. The patients were treated with both ranibizumab and bevacizumab. The patients who were initially treated with ranibizumab received 3 monthly injections initially, and the patients who were treated with bevacizumab received only one initial injection. Then the patients received the intravitreal injections as needed. The retreatment criteria were different from PRONTO study criteria, and were as follows; VA loss, or presence of subretinal fluid. The VA and anatomic outcomes were better in avascular PED group, the baseline VA was 0.12 Snellen equivalent and the VA at month 24 was 0.14 Snellen Equivalent. Whereas, the baseline VA decreased from 0.06 to 0.23 Snellen equivalent in PCV group, and decreased from 0.16 to 0.70 Snellen equivalent in occult CNV group. The mean number of injections was 0.7 in avascular PED group, 2.6 in PCV group, and 4.2 in occult CNV group, respectively. The visual and anatomic outcomes of the occult CNV group were worse than our study and the other good vision studies. This may be due to the irregularity of the initial treatments, and/or the insufficiency of retreatment criteria as only two criteria were defined for reinjection. As a result, PCV and occult CNV groups had fewer injections than the other studies.

The VA loss during the as-needed treatment regimens is usually irreversible. A delay in ranibizumab treatment, the presence pigment epithelial detachment at the baseline, and CRT fluctuations may be the causes of the VA loss [23–25]. Muether et al. [23], reported that there had been a 1.1 LogMAR line difference in the VA between the patients
with a treatment delay of ≤ 28 days and > 28 days. The final VA was found to be better in the patients who had a treatment delay of ≤ 28 days than the patients who had a delay time of > 28 days. In a study by Mariani et al. [25], the characteristics of the patients with secondary VA loss during as-needed treatment were evaluated. They reported that the presence of PED at the baseline was a negative prognostic factor for the final VA, and the complete visual recovery was not achieved after VA loss.

In this study, IVR on as-needed treatment regimen was found to be effective in nAMD patients with a VA of ≥ 20/40 in preserving VA. Although no significant VA gain was achieved, it was possible to prevent VA loss in most of the patients (94.8%) after a follow-up time of 12 months. The patients who required additional injections after the three loading doses had an unfavorable functional outcome than the patients who did not require further injections. The presence of PED at the baseline was found to be a negative predictor factor for the final visual acuity outcome, and it was significantly more frequent in the group of patients who required further injections. In addition, the patients who experienced VA loss as a retreatment criterion had a worse visual outcome than the patients who did not experience VA loss.

The main limitation of the study was its retrospective design. We used a time domain OCT device and only persistence of subretinal fluid was defined as retreatment criterion; however, persistent intraretinal fluid was not. The powerful sides of this study are; the homogeneity between the patients, the exclusion of the patients with PCV and RAP; and the sufficient number of the patients included in the study considering that only nAMD patients with good baseline acuity were evaluated.

In conclusion, IVR is an effective treatment option for the nAMD patients with good baseline VA. VA loss is usually irreversible in this group of patients, presence of PED at the baseline is a negative predictive factor for the final visual outcome, and indicates the need for further re-injection after the first loading doses.

Disclosure of interest

The authors declare that they have no conflict of interest concerning this article.

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Ranibizumab for nAMD with good visual acuity


