CASE REPORT

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Early Development of Two Neovascular Glaucoma Cases Following Central Retinal Artery Occlusion

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ABSTRACT Central retinal artery occlusion (CRAO) is an ophthalmic emergency which causes sudden loss of vision. One of its most serious complications is neovascular glaucoma (NVG), and frequently seen between mostly the second and third months after the diagnosis. In this study, 2 cases of immediately developing glaucoma after CRAO are presented and possible risk factors are discussed. Our first case who developed NVG within four weeks could not complete her treatment due to myocardial infarct during hyperbaric oxygen treatment. On the other hand, our second case was referred to hyperbaric oxygen treatment but her treatment could not begin due to a gynecological disease and she could not attend her regular follow-ups. When these two cases, having NVG within four week after CRAO are examined, it should be considered that early development NVG may occur immediately after CRAO as an additional disease, which may increase ischemia, in patients who are incompatible and not attending follow-ups regularly.

Keywords: Glaucoma; neovascular; retinal artery occlusion; aflibercept

Central retinal artery occlusion (CRAO) is an ophthalmic emergency causing indolent sudden vision loss.[1] Among its long term complications, iris neovascularization with a rate of 1-20% is also seen.[2] Although neovascularization can be observed at any time, it is mostly seen between the second and the third months.[2,3] Neovascular glaucoma (NVG) might be the reason for loss of current visual acuity and intense pain. It is also a serious complication which impairs the quality of life of the patient. In cases of intense ischemia of retina, there is more risk for the development of neovascularization.[3,4]

Hyperbaric oxygen treatment as one of the promising treatment options for retinal artery occlusion provides increase in long-term visual acuity.[5] In the treatment of NVG developing after CRAO, applying pan-retinal laser photocoagulation and intravitreal anti-vascular endothelial growth factor (VEGF) injection are the treatment modalities in decreasing neovascularization. In this paper, possible risk factors for early neovascularization developing after CRAO and current NVG treatment methods are discussed through the presentation of two cases who developed NVG immediately after CRAO.

CASE REPORTS

CASE 1

A seventy-four-year-old woman applied to the outpatient clinic due to three-hour indolent sudden vision loss in the right eye and palpitation. The patient was examined by a cardiologist. Her cardiac examination findings were reported to be normal. Afterwards with the diagnosis of CRAO, she was referred to our outpatient clinic by an ophthalmologist at the seventh hour of her visual complaint. She had a history of systemic hypertension. Her vision acuity was at the level of finger counting from one meter in her right eye and 0.5 log MAR in her left eye. Bilateral pseudophakia was observed during slit lamp examination. During right fundus examination of the patient, her retina was pale, and fovea was hyperemic (Cherry-red spot) and left fundus examination revealed pallor of the optic disc nerve (Figure 1 and 2). In the fundus fluorescein angiography (FFA), possible occlusion region showed hyper fluorescence at the level of CRAO on optic disc. Filling defects of arterioles, and residual staining on upper nasal and lower temporal arterioles close to the optic nerve were observed (Figure 3 and 4). The patient was hospitalized and the treatment for CRAO was applied. Although the patient's consultation time was late, timolol maleate 0.05% drop 2x1, ocular massage and carbogen treatment were initiated. Carotid arterial Doppler ultrasonography was reported as normal. Sedimentation was at normal level and temporal arteritis was excluded after the evaluation by a rheumatologist. After the approval of cardiologist, the patient was referred to hyperbaric oxygen treatment. When the patient completed the fourth session of hyperbaric oxygen treatment, she had myocardial infarction and a

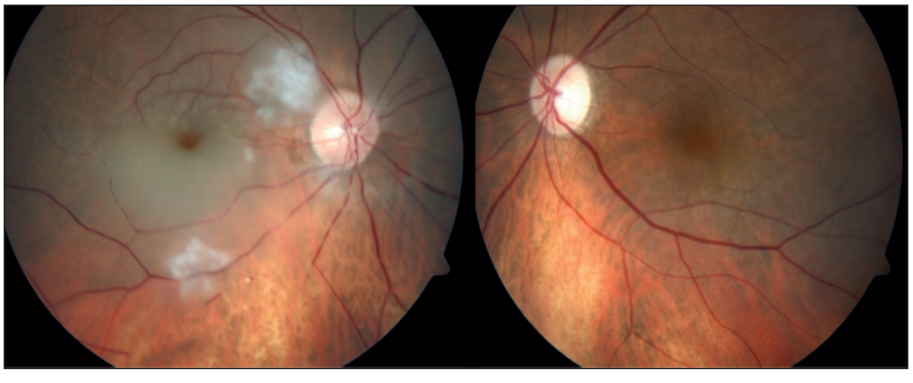

FIGURE 1-2: Color photography of Case 1: Right retina was pale, and fovea was hyperemic (cherry-red spot) and left fundus examination revealed pallor of the optic disc nerve.

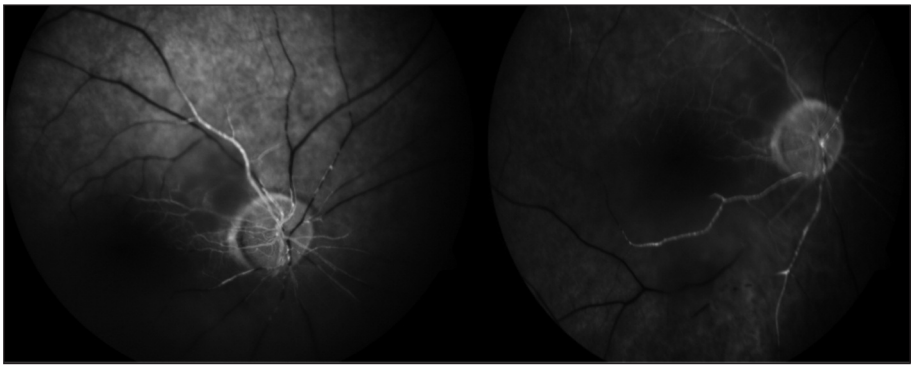

FIGURE 3-4: Fundus fluorescein angiography photography of Case 1: Possible occlusion region showed hyper fluorescence at the level of CRAO on optic disc. Filling defects of arterioles, and residual staining on upper nasal and lower temporal arterioles close to the optic nerve are observed.

stent was placed in her 85% occluded left coronary artery under angiography in emergency condition. Iris neovascularization was observed during her control examination after three weeks. The patient's right eye intraocular pressure was 16 mm/Hg. In the same day, pan-retinal laser photocoagulation was initiated. One week later, her right eye vision acuity was at the level of finger counting from 50 cm with eye pain and intraocular pressure was 36 mm/Hg with applanation tonometry. She was hospitalized with the diagnosis of neovascular glaucoma again and intravenous mannitol 20%, oral acetazolamide and topical brinzolamide+timolol maleate fixed combination were applied bid. Panretinal laser photocoagulation and intravitreal anti-VEGF as aflibercept were applied. During her control visit, intraocular pressure of the right eye decreased to 20 mm/Hg and she was discharged with brinzolamide-timolol combination by her own will.

CASE 2

A fifty-five-year-old woman with complaint of vision loss for a couple of days in her left eye was referred with the diagnosis of CRAO to our outpatient clinic. She had also diabetes mellitus and systemic hypertension. Visual acuity in her left eye was at the level of hand movements, while it was at 0.7 log MAR in her right eye. During slit lamp examination, no pathological findings were observed other than bilateral lenticular cortical opacity. In the fundus examination of the left eye, retina was pale and fovea was hyperemic (Cherry-red spot). Hemorrhages were seen in retina of her right eye (Figure 5 and 6). The patient was hospitalized in our clinic with the diagnosis of CRAO. Fundus fluoroscein angiography revealed disc neovascularization in the left eye with vascular filling defect and neovascularization elsewhere in the right eye (Figure 7 and 8). Same as in the first case, treatment of topical brinzolamide and carbogen were initi-

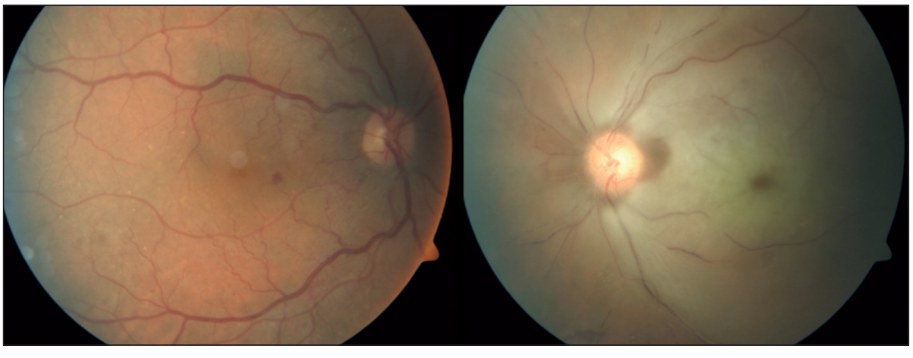

FIGURE 5-6: Color photography of Case 2: In the fundus examination of left eye, retina was pale and fovea was hyperemic (Cherry-red spot). Hemorrhages were seen in retina of her right eye.

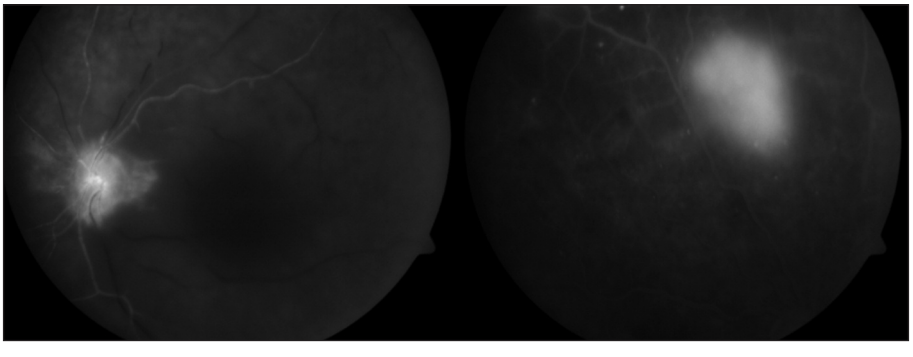

FIGURE 7-8: Fundus fluorescein angiography photography of Case 2: Disc neovascularization was observed in the left eye with vascular filling defect and neovascularization elsewhere in the right eye.

ated for medicolegal purposes. Sedimentation level was found to be normal. The patient, with no identification of additional pathologies after consultations in cardiology, internal diseases and rheumatology departments, was directed to hyperbaric oxygen treatment. The patient who could not receive treatment as the device was out of order did not come back during this period. After three weeks from the CRAO diagnosis, she was hospitalized with the suspicion of myoma uteri and endometrium malignancy in the Department of Gynecological Oncology. She underwent abdominal hysterectomy and bilateral salpingo-oophorectomy. A consultation was performed due to her complaint of pain in her left eye for one week. The visual acuity of the patient's left eye was light perception and intraocular pressure was measured as 53 mm/Hg. Intravenous mannitol, oral acetazolamide and topical brinzolamide-timolol maleate fixed combination bid and brimonidine bid were started. Panretinal laser photocoagulation was initiated with NVG diagnosis, and intravitreal anti-VEGF injection as aflibercept was performed. On the third day of her control, intraocular pressure was measured as 24 mm/Hg with applanation tonometry. As the patient did not want to be followed up and treated, she was discharged by her own will. The patient who could not be treated due to technical issues regarding hyperbaric oxygen device, did not attend her control examination as well.

DISCUSSION

Ocular neovascularization develops as a serious complication after chronic retinal ischemia. Even though it is mostly seen in diseases such as central retinal vein occlusion, ocular ischemic syndrome and diabetic retinopathy, it is stated that it also develops after CRAO at the rate of 19%.[1] In a study conducted by Rudkin et al., it was shown that there was a significant relationship between thromboembolic CRAO and development of neovascularization even in patients with no diabetes and no carotid artery occlusion.[2] Additionally, in a study by Hayreh et al.; diabetes, hypertension, coronary artery disease, ischemia cerebrovascular and renal diseases and smoking were found as systemic risk factors for CRAO.[6] Additionally, each disease which may increase the current ischemia would theoretically intensify the development of neovascularization.

In order to decrease ischemia in retinal tissues and increase reperfusion; reducing intraocular pressure and applying ocular massage to move the current emboli plaque further are the treatment methods used for many years in patients who has CRAO.[2,7] On the other hand, hyperbaric oxygen treatment applied for retina not to stay ischemic until reperfusion occurs is a newer treatment method mentioned recently.[8] Despite all these treatments, permanent chronic ischemia occurring after occlusion is the main factor in the development of neovascularization.[9] Despite not being treated earlier, we applied medical treatment and ocular massage, initiated carbogen treatment immediately in order to reduce intraocular pressure. We referred the patients who did not have regression in their findings, to hyperbaric oxygen treatment urgently after examining etiological reasons.

After ischemia develops, VEGF level increases as a result of the development of neovascularization.[10,11] Neovascularization on the iris and angle causes emergence of a fibrovascular membrane in the anterior segment. As a result of the fibrovascular membrane, intraocular pressure increases with closure of the angle.[12] Panretinal laser photocoagulation is the current gold standard treatment method to reduce VEGF level. As Duker and Brown indicated, there has been regression in 65% of the patients who underwent panretinal laser photocoagulation as a treatment to regress the development of neovascularization of the iris (NVI) after CRAO in their studies.[13] Previous studies showed the success of intravitreally injected anti-VEGF molecule alone or in combination with panretinal laser for neovascularization regression.[14,15] Moreover, it is the first use of aflibercept with a single dose for treating the development of neovascularization after CRAO. To the best of our knowledge, this is the first report in the literature.

The first patient was referred for hyperbaric oxygen treatment. However, she could not com-

plete her treatment sessions as coincidentally having acute myocardial infarction. It has been reported that hyperbaric oxygen treatment applied in the first 12 hours when ischemia might be reversible and no permanent damage might be observed resulted in better final visual acuity due to oxygenation of the retinal inner layers.[8] It has been reported that the patients having a treatment with hyperbaric oxygen showed a decrease in neovascularization empirically. This was observed in previous reports about the frequency of development of neovascularization after hyperbaric oxygen treatment.[5] Reduction in the intensity of ischemia and having less permanent damage in retinal tissues which was fed by externally given oxygen might cause less vascular endothelial growth factor release and less neovascularization after hyperbaric oxygen treatment. Cardiac issue might intensify the ischemia and contributed to a faster development of neovascularization in spite of the treatment in our cases. Within the scope of the data revealed above, after the development of neovascular glaucoma, we applied intravitreal anti-VEGF injection as aflibercept and panretinal laser photocoagulation treatment to our patient. Furthermore, regression of the signs namely iris neovascularization and intra ocular pressure was observed.

On the other hand, the second patient could not receive hyperbaric oxygen treatment due to the fact that having systemic diseases might result in serious level of ischemia especially on the basis of diabetic retinopathy. Ocular pain emerged within a short period of time as three weeks and diagnosed as neovascular glaucoma on the fourth week. The patient was injected anti-VEGF as aflibercept intravitreally and pan-retinal laser photocoagulation treatment was applied after the development of NVG. We observed the response in a very short time period.

As a result, neovascular glaucoma which might develop after CRAO is a serious complication which impairs the patient's quality of life. Patients recommended to have treatment could not apply to a hospital or complications such as myocardial infarct which may increase ischemia could be seen. Therefore, such patients should have closer follow ups.

Informed Consent

Written informed consent was obtained from the patients for publication of this case report and accompanying images.

Source of Finance

During this study, no financial or spiritual support was received neither from any pharmaceutical company that has a direct connection with the research subject, nor from a company that provides or produces medical instruments and materials which may negatively affect the evaluation process of this study.

Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

Authorship Contributions

Idea/Concept: *Hakan Yıldırım, Mehmet Canleblebici;* ***Design:*** *Mehmet Canleblebici;* ***Control/Supervision:*** *Ülkü Çeliker, Mehmet Balbaba;* ***Data Collection and/or Processing:*** *Mehmet Canleblebici;* ***Analysis and/or Interpretation:*** *Mehmet Balbaba;* ***Literature Review:*** *Hakan Yıldırım, Mehmet Canleblebici;* ***Writing the Article:*** *Hakan Yıldırım;* ***Critical Review:*** *Ülkü Çeliker;* ***References and Fundings:*** *Ülkü Çeliker;* ***Materials:*** *Mehmet Canleblebici.*

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