· Original article ·

Laser treatment in 341 patients with exudative age-related macular degeneration

Leyla Atmaca[1], *Aysun Idil*[2], *Pelin Atmaca-Sönmez*[3]

[1]Department of Ophthalmology, Private Practice, Ankara, Turkey
[2]Department of Public Health, Low Vision Rehabilitation and Research Center, Faculty of Medicine, Ankara University, Ankara, Turkey
[3]Department of Ophthalmology, Nurlu Eye Center, Ankara, Turkey

Correspondence to: Leyla Atmaca. Department of Ophthalmology, Private Practice, Ankara, Turkey. leylaatmaca@ttmail.com
Received: 2011-02-12 Accepted: 2011-05-20

Abstract

• AIM: To document the prognosis of laser treatment in patients with exudative age-related macular degeneration (AMD).

• METHODS: Efficacy of the intervention was evaluated using a before-after method.

• RESULTS: A total of 392 eyes of 341 patients with exudative AMD were examined. 77.6% had choroideal neovascularisation (CNV). Before the use of indocyanine green (ICG) angiography, occult CNV was detected in only 1.8% of the eyes, but after the use of ICG angiography, this increased to 19.5% ($P<0.001$). Of the 349 eyes which were followed up, visual acuity had remained stable in 68.2% of the eyes. There was a statistically significant relationship between localization of lesion and visual acuity changes on pre-and post-laser treatment ($P<0.001$). Also there was a statistically significant relationship between localization of lesion and recurrence ($P<0.05$). The recurrence was less in subfoveal lesions than that in juxtafoveal and extrafoveal lesions.

• CONCLUSION: ICG angiography is highly important in the treatment of occult CNV.

• KEYWORDS: red krypton laser; green argon laser; dye laser; exudative age-related macular degeneration; indocyanine green angiography

DOI:10.3969/j.issn.1672-5123.2011.07.002

Atmaca L, Idil A, Atmaca-Sönmez P. Laser treatment in 341 patients with exudative age-related macular degeneration. *Guoji Yanke Zazhi (Int J Ophthalmol)* 2011;11(7):1132-1136

INTRODUCTION

Age-related macular degeneration (AMD) is now the leading cause of blindness and severe vision loss among people over the age of 40 in developed countries. Although there is no treatment for advanced dry AMD (geographic atrophy), there have been considerable advances in the management of neovascular AMD[1]. Treatments are currently available for the diseases including laser photocoagulation, verteporfin photodynamic therapy, and intravitreal injections of corticosteroids and anti-angiogenic agents. Many studies have reported the benefits of each of these treatments, although none is without its risks[2]. In the last few decades, the mainstay of treatment for choroidal neovascularization (CNV) due to AMD has been thermal laser photocoagulation[3]. Laser photocoagulation has been used as a treatment modality since 1970. Many studies confirmed that laser photocoagulation to CNV reduced the risk of severe visual loss in AMD. For extrafoveal lesions the most common treatment modality is still laser treatment. Our aim was to document the prognosis of laser treatment in patients with exudative AMD.

MATERIALS AND METHODS

Materials Between Nov. 1983 and Nov. 2005, we examined 341 patients with exudative AMD. There was no control group with laser treatment for ethical reasons in this study, which was designed as a retrospective interventional study.

Methods Efficacy of the intervention was evaluated using a before-after method. In total, 392 eyes of 341 patients received photocoagulation treatment (from Leyla Atmaca) in a private clinic for exudative AMD, including CNV and retinal pigment epithelial detachment (PED). In the presence of CNV with pigment epithelial detachment, laser was applied only to the CNV and not to PED. Treatment was done under topical anesthesia using green argon, red krypton and dye laser. Lesion localization was classified as subfoveal, juxtafoveal and extrafoveal. Juxtafoveal and extrafoveal lesions were covered completely. Foveola and papillomacular areas were left free in subfoveal cases, and laser was applied in a horseshoe shape. Laser photocoagulation was performed monocularly on 290 patients and binocularly on 51 patients. Of the patients, 52.8% (180 patients) were male and 47.2% (161 patients) were female, and the mean age was 68.2±8.4 years. There was no significant statistical difference between female and male groups according to distribution of age groups and mean age ($P>0.05$). Evaluation criteria were visional changes before and after laser, and the state of recurrence. Vision after laser was recorded as best-corrected visual acuity (BCVA) 6 months after the treatment. BCVA (LogMar) was based on ETDRS charts. Vision change was accepted as 0.1 log of increase or decrease in visual acuity.

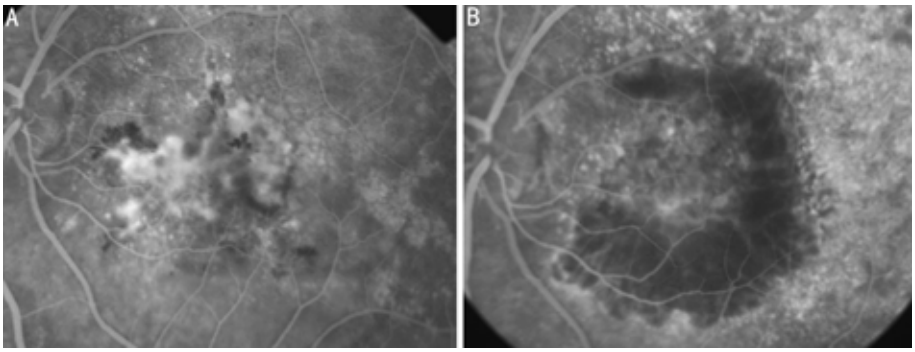

Figure 1 Subfoveal CNV before and one month after laser treatment A:Before VA: 20/400;B:After VA: 20/200.

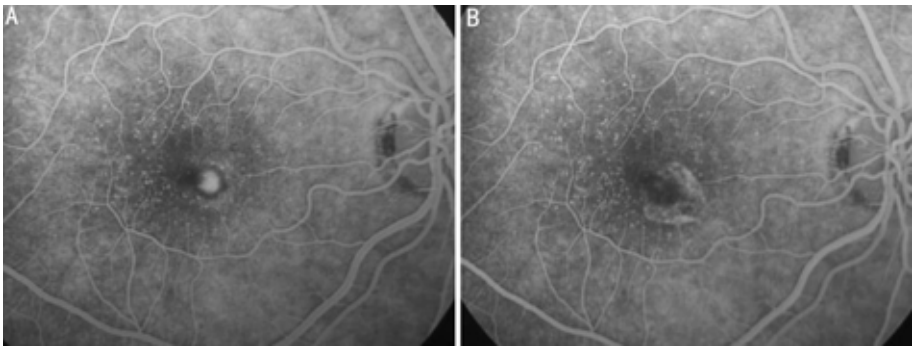

Figure 2 Juxtafoveal CNV with red krypton laser treatment A:Before VA:0.4; B:Three months after laser treatment VA:0.7.

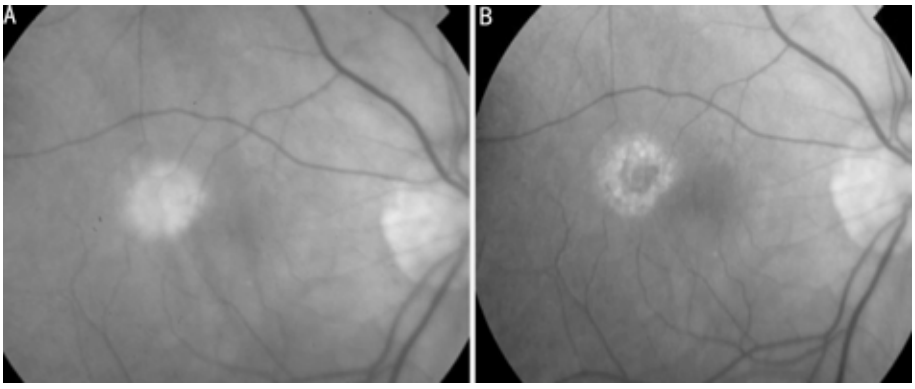

Figure 3 Extrafoveal CNV after red krypton laser A:Immediately VA:0.7; B:One month after laser treatment VA:0.7.

Presence of fluorescein leakage in the periphery of laser lesion in the six weeks following treatment was accepted as persistence and, after six weeks, as recurrence. For recurrent CNV, treatment should extend 100m beyond the perimeter of the lesion and 300m beyond the previous area of photocoagulation. The vast majority of the eyes received krypton laser (89.5%). Laser was performed 1.3 ± 0.6 times per eye on average and the maximum was 4 times. The treatments performed before and after routine ophthalmologic examination were color fundus photography, fluoresceine angiography (FA) and if necessary ICG angiography (since September 1993). FA was performed at 1 month, 3, 6 and 12 months after laser treatment. The mean follow-up was 19.0 ± 32.9 (range: 3-126) months.

Statistical Analysis Data was analyzed with SPSS 15 Packet Software.

RESULTS

The distribution of exudative AMD type was according to the localization of lesions. 77.6% had CNV, 19.9% CNV with PED and 2.6% only PED of the eyes (Table 1). 62% of lesions were located subfoveally (Figure 1), 26.5% juxtafoveally (Figure 2) and 11.5% extrafoveally (Figure 3). There was no significant statistical difference between exudative AMD type and localization of lesions ($P > 0.05$). Before the use of indocyanine green (ICG) angiography, occult CNV was detected in only 1.8% of the eyes, but after the use of ICG angiography, this increased to 19.5% ($P < 0.001$, Figure 4).

Vision change and the state of recurrence after laser were evaluated for 349 eyes at regular intervals (Table 2). Of the 349 eyes which were followed up, visual acuity had increased in 14.3%, decreased in 17.5% and remained stable in 68.2% of the eyes. There was a statistically significant relationship between localisation of lesion and visual acuity changes on pre-and post-laser treatment ($P < 0.001$). Stability of pre-and post-laser vision correction was found to be higher in subfoveal lesions (75.6%) compared to juxtafoveal (62.8%) and extrafoveal lesions (42.9%). The difference was statistically significant considering this relationship ($P < 0.001$). After laser treatment on 42 eyes

Table 1　Lesion localization (392 eyes) and recurrence (349 eyes) on exudative AMD　*n*(%)

Localization	Recurrence						
	CNV	CNV + PED	PED	Total	Yes	No	Total
Subfovea	197(64.8)	42(53.8)	4(40.0)	243(62.0)	37(17.4)	176(82.6)	213(100)
Juxtafoveal	78(25.7)	23(29.5)	3(30.0)	104(26.5)	27(28.7)	67(71.3)	94(100)
Extrafoveal	29(9.5)	13(16.7)	3(30.0)	45(11.5)	12(28.6)	30(71.4)	42(100)
Total	304(77.6)	78(19.9)	10(2.6)	392(100)	76(21.8)	273(78.2)	349(100)

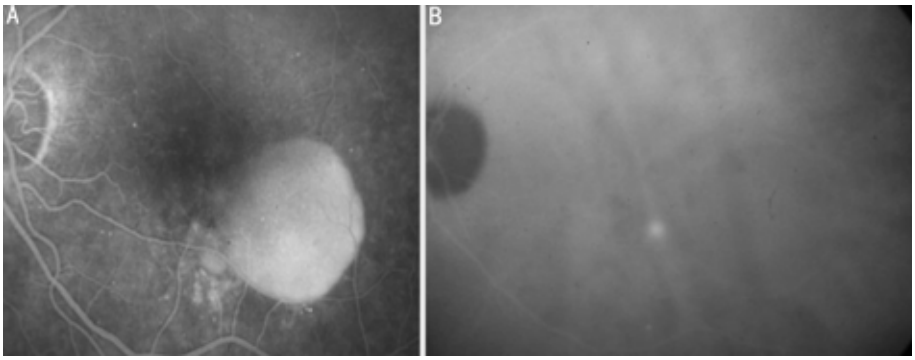

Figure 4　Hyperfluorescent　A:PED(FA); B:Late-phase ICG.

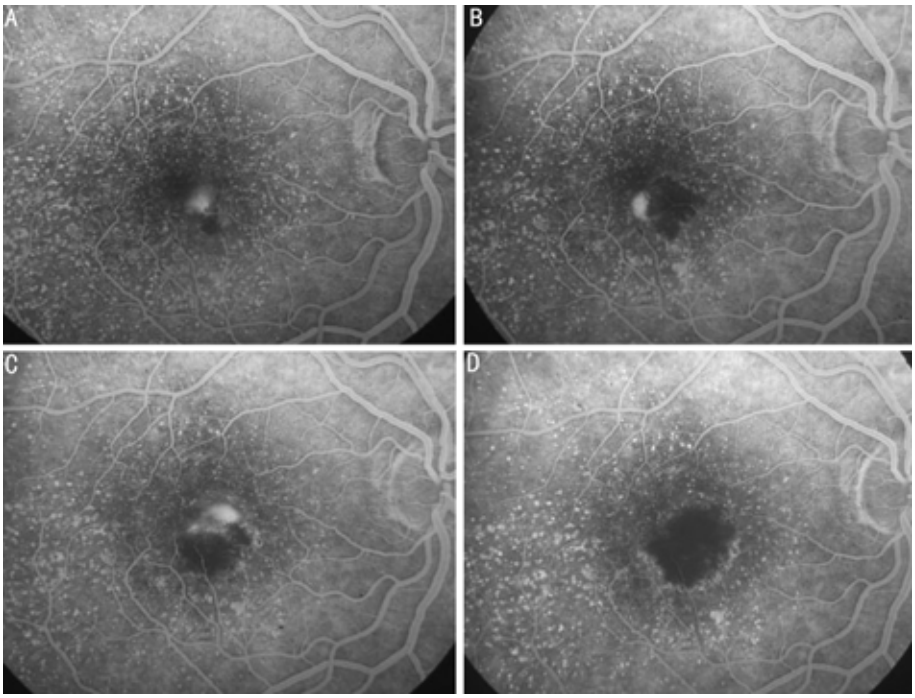

Figure 5　Juxtafoveal CNV with laser treatment　A: Before VA:0.5; B:15 days after first treatment VA:0.5; C: 18 days after second treatment VA:0.3; D: 20 days after third treatment VA:0.3.

with extrafoveal lesion, visual acuity increased by 28.6%; a much higher rate than with other lesions.

Vision change after laser was evaluated according to AMD type. However, vision remained stable after laser only in the 10 eyes that just had PED. ICG angiography has been used since 1993. The ten eyes which were diagnosed as only having PED were not able to receive ICG angiography diagnostic as it was not available until 1993. These eyes could had occult CNV. For this reason, statistical evaluation was carried out for 339 eyes with CNV and CNV + PED, excluding the 10 eyes with PED, and consequently, a statistically significant relationship was detected between AMD type and vision change after laser ($P<0.05$). Accordingly, increase in vision acuity after laser was found to be twice as high in eyes with CNV + PED (24.3%) as in eyes only with CNV (12.3%, Table 2).

Also there was a statistically significant relationship between localization of lesion and recurrence ($P<0.05$). Recurrence was detected in 76 (21.8%) of 349 eyes (Figure 5). The recurrence was less in subfoveal lesions (17.4%) than that in juxtafoveal (28.7%) and extrafoveal (28.6%) lesions (Table 1). Laser treatment was applied to both eyes in 51 out of the 341 patients included in the study. Vision change before and after laser treatment, recurrence, exudative AMD type and lesions were compared for both eyes in 49 patients regularly examined. However, rather low and statistically insignificant correlations were detected between the right and left eyes considering the investigated variables ($P>0.05$).

Table 2 Visual acuity change after laser treatment *n*(%)

Localization	Visual acuity			
	Increased	Decreased	Stable	Total
Subfovea	l26(12.2)	26(12.2)	161(75.6)	213(61)
Juxtafoveal	12(12.8)	23(24.5)	59(62.8)	94(26.9)
Extrafoveal	12(28.6)	12(28.6)	18(42.9)	42(12.1)
Total	50(14.3)	61(17.5)	238(68.2)	349(100)
Type				
CNV	33(12.3)	48(17.8)	188(69.9)	269(100)
CNV + PED	17(24.3)	13(18.6)	40(57.1)	70(100)
Total	50(14.7)	61(18.0)	228(67.3)	339(100)

DISCUSSION

CNV localization was 60%-80% subfoveal in other studies[4]. This rate was determined as 62% in the present study. No statistically significant relationship was found between the type of exudative AMD (choroid neovascularization and/or pigment epithelium detachment) and lesion location. Classic CNV is evidently observed in FA. Many researchers have stated the superiority of FA over ICG angiography in the determination of classic CNV[5,6]. However, occult CNV can not be clearly detected in FA. ICG angiography is an ideal method to examine choroid veins and detect occult CNV. ICG angiography is superior to FA in detecting occult CNV. Occult CNV were determined as 44% and 45.8% in our previous studies[7,8]. In this group, occult CNV before ICG angiography was observed only in 1.8% of eyes, while the same rate after ICG angiography was found to be statistically significant. A good quality fluorescein and ICG angiography for occult lesions of 72 hours maximum should be obtained before planning the treatment. In the presence of CNV with pigment epithelial detachment, laser is applied only to the CNV and not to PED. If CNV is not seen on ICG angiography, then laser is not performed. In the management of occult CNV, laser is recommended for the hot spot.

The vast majority of the eyes received krypton laser (89.5%). Although there are no statistically determined differences in VA values between blue-green argon, green argon and red krypton laser-treated eyes, red krypton seems to be more effective since juxtafoveal and subfoveal CNV, which are difficult to treat and associated with lower VA, were assigned to red krypton photocoagulation. Also, while being at least as effective as green argon in extrafoveal CNV, krypton can indicate the presence of hemorrhage in the lesion[9]. BCVA remained stable 6 months after laser treatment in 68.2% of the eyes regularly checked (349 out of 392 eyes). Pre-and post-laser stability of vision acuity was 75.6% in subfoveal lesions, and statistical significance in Table 2 was high for this correlation. In fact, as neovascularization is located in the centre of the fovela avascular zone, vision prognosis is bad both in natural course and photocoagulation. However, it was difficult to interpret this situation in the study as subfoveal lesions were not grouped in terms of size and the distance of lesions from fovea. On the other hand, vision was already bad in this group before laser treatment; therefore, vision was found stable after laser treatment. As for the lesion with extrafoveal location, increase in pre-laser vision acuity was twice as high as those with subfoveal and extrafoveal locations. Clinical studies demonstrated that laser photocoagulation considerably reduced vision loss in the lesion with extrafoveal locations[10]. Increase in vision acuity following laser treatment was found to be higher in the eyes with CNV + PED compared to the eyes with only CNV. This could be attributed to the higher extrafoveal localization in the eyes with PED + CNV. The presence of fluorescein leakage in the periphery of laser lesion in the six weeks following treatment was accepted as persistence and, after six weeks, as recurrence. Recurrence was found to be lower in subfoveal lesions compared to extrafoveal and juxtafoveal lesions. Recurrence was detected in approximately one third of extrafoveal and juxtafoveal lesions at the sixth month examination. Other studies have detected recurrence in about half of the extrafoveal and juxtafoveal lesions within two years[11,12]. For the patients with exudative AMD in one eye, the risk of having exudative changes in the other eye was reported as being between 3%-28%[13].

In the present study, the development of exudative AMD in the other eye of patients' with exudative AMD in one eye was found to be 14.9%. It was investigated in these patients whether the first eye could be a predictive indicator for the other eye. However, there were rather low and statistically insignificant correlations between the two eyes, considering pre-and post-laser vision change, recurrence, exudative AMD type and lesion localization.

In conclusion, ICG angiography is highly important in the treatment of occult CNV. After the laser treatment of extrafoveal lesions, visual acuity increased at a higher rate than other lesions. The recurrence rate was the highest with the juxtafoveal lesions. Laser photocoagulation was the most common and effective method used before starting anti-VEGF treatment methods in exudative AMD. Laser photocoagulation can still be used in the extrafoveal lesions which cannot be treated with anti-VEGF methods.

REFERENCES

1 Cook HL, Patel PJ, Tufail A. Age-related macular degeneration: diagnosis and management. *Br Med Bull* 2008;85:127-149

2 Augustin AJ, Scholl S, Kirchhof J. Treatment of neovascular age-related macular degeneration: current therapies. *Clin Ophthalmol* 2009;3:175-182

3 Emerson MV, Lauer AK. Current and emerging therapies for the treatment of age-related macular degeneration. *Clin Ophthalmol* 2008;2(2):377-388

4 Bressler SB, Bressler NM, Fine SL, Hillis A, Murphy RP, Olk RJ, Patz A. Natural course of choroidal neovascular membranes within the avascular zone in senile macular degeneration. *Am J Ophthalmol* 1982;93(2):157-163

5 Yanuzzi LA, Slakter JS, Sorenson JA, Guyer DR, Orlock DA. Digital indocyanine green videoangiography and choroidal neovascularization. *Retina* 1992;12(3):191-223

6 Yuzawa M, Kawamura A, Yamaguchi C, Shouda M, Shimoji M, Matsui M. Indocyanine green videoangiographic findings in detachment of

retina pigment epithelium. *Ophthalmology* 1995;102(4):622-629
7 Atmaca LA, Batıoğlu F, Atmaca P. Evaluation of choroidal neovascularization in age related macular degeneration with fluorescein and indocyanine green videoangiography. *Ophthalmologica* 1996; 210 (3):148-151
8 Atmaca LA, Batıoğlu F, Atmaca P. ICG Videoangiography of occult choroidal neovascularization in age related macular degeneration. *Acta Ophthalmol Scan* 1997;75(1):44-47
9 Atmaca LS, Özmert E, Gündüz K. Comparison of photocoagulation treatment in exudative age-related macular degeneration with the blue green argon, green argon and red krypton laser wavelengths. *Ophthalmologica* 1993;207(1):45-54
10 Macular Photocoagulation Study Group. Argon laser photocoagulation for senil macular degeneration: results of a clinical randomized trial. *Arch Ophthalmol* 1982;100(8):912-918
11 Macular Photocoagulation Study Group. Argon laser photocoagulation for neovascular maculopathy. *Arch Ophthalmol* 1991;109( ):1109-1114
12 Macular Photocoagulation Study Group. Persistent and recurrent neovascularization after krypton laser photocoagulation for neovascular lesion of age-related macular degeneration. *Arch Ophthalmol* 1990;108 (6):825-831
13 Hanutsaha P, Guyer DR, Yannuzzi LA, Naing A, Slakter JS, Sorenson JS, Spaide RF, Freund KB, Feinsod M, Orlock DA. Indocyanine green videoangiography of drusen as a possible predictive indicator of exudative maculopathy. *Ophthalmology* 1998; 105 (9): 1632-1636

渗出性年龄相关性黄斑变性 341 例激光治疗效果分析

Leyla Atmaca[1], Aysun İdil[2], Pelin Atmaca-Sönmez[3]
(作者单位:[1]土耳其安卡拉私人诊所眼科;[2]土耳其安卡拉大学医学院低视力康复研究中心公共卫生系;[3]土耳其安卡拉 Nurlu 眼科中心)
通讯作者:Leyla Atmaca. leylaatmaca@ ttmail. com

摘要

目的:探讨渗出性年龄相关性黄斑变性(AMD)患者激光治疗的预后。

方法:前后比较,以评价治疗的有效性。

结果:共纳入 341 例 392 眼渗出性 AMD 病例,其中 77.6% 伴有脉络膜新生血管(CNV)。未使用吲哚氰绿(ICG)血管造影时,仅在 1.8% 患眼发现隐匿性 CNV;而使用 ICG 血管造影后,该比例提高到 19.5%($P<0.001$)。激光治疗后,共 349 眼进入随访,其中 68.2% 视力保持稳定。经统计学检验,病变部位与治疗前后视力改变相关($P<0.001$),也与病变复发相关($P<0.05$)。在黄斑中心凹区病变的复发率小于旁中心凹或中心凹外病变。

结论:ICG 血管造影对研究隐匿性 CNV 治疗效果相当重要。

关键词:氪红激光;氩绿激光;染料激光;渗出性年龄相关性黄斑变性;吲哚氰绿血管造影