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Research Article

Comparison of Anti VEGF and Laser Photocoagulation in Diabetic Macular Edema (DME)

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Abstract

Background: To investigate the relationship of central macular thickness measure and visual acuity in diabetic macular edema (DME) before and after treatments using Ranibizumab, Bevacizumab and laser.

Materials and Methods: A comparative cross-sectional retrospective study was done in Khartoum state at Al Faisal Eye Center. Heidelberg OCT was used to measure central macular thickness and visual acuity (BCVA) was evaluated by Snellen's chart. The data were analyzed by SPSS 20.

Result: A total of 102 treated patients including both male/female were enrolled with mean age 55 ± 5.41. Paired sample t-test showed a significant difference in all types of treatments based on mean vision of treated patients. With Ranibizumab the pre and post treatment mean vision was (0.20 ± 0.16) and (0.30 ± 0.25) respectively with t (-3.2) and P value 0.002. With Bevacizumab it was (0.18 ± 0.16) and (0.37 ± 0.26) respectively with t (-6.12) P value < 0.001 and with laser it was (0.28 ± 0.20) and (0.38 ± 0.27) respectively with t (-2.8) and P value 0.008.A significant difference was found in all types of treatments regarding mean of central macular thickness of treated patients. In patients treated with Ranibizumab the pre and post treatment thickness was (403.6 ± 127) and (293.6 ± 72.7) respectively with t (5.92), with Bevacizumab it was (389.3 ± 134.2) and (276.1 ± 62.6) respectively with t (5.93) and with laser it was (370.1 ± 120.7) and (280.9 ± 64.3) respectively with t (4.67) and P value < 0.001.

Conclusion: Diabetic macular edema leads to blurred vision ranging from slight blurring to noticeable vision loss and Bevacizumab showed sustained improvements in vision and retinal anatomy than Ranibizumab and laser.

Keywords: *Central Macular Thickness; Vascular Endothelial Growth Factor; Vision; Diabetic Macular Edema; Ocular Coherence Tomography*

Introduction

Macular edema is a major cause of central vision impairment in people with diabetic retinopathy. It results from the accumulation of fluid in the outer plexiform and inner nuclear layers of the retina with the formation of cyst [1].

The primary symptom of macular edema is blurry or wavy vision near or in the center of the field of vision. Colors might also appear washed out or faded. Most people with macular edema will have symptoms that range from slightly blurry vision to noticeable vision loss [2]. Various means to reduce the risk of vision loss from diabetic macular edema (DME) include focal laser photocoagulation [3,4], intensive glycemic control [5] and blood pressure control [6]. DME resulted from all types of diabetes except gestational diabetes.

Ranibizumab (Lucentis) is a humanized mono clonal antibody fragment developed specifically for use in the eye. In contrast to ranibizumab, Bevacizumab (Avastin) is a complete antibody and is very cheap. Bevacizumab is larger molecule than Ranibizumab and it may be retained in the vitreous for a longer period, so may need to be given less frequently [7]. Laser photocoagulation is also a well-proven therapy to reduce the risk of vision loss from the diabetic macular edema.

Using optical coherence tomography (OCT), it is now possible to measure objectively macular thickness and investigate quantitively the relationship of DME and visual acuity [8].

It detects relative changes in refraction at optical interfaces by the method of low-coherence interferometry. The outer most (red-white) band corresponds to the retinal pigment epithelium-chorio capillaries complex, while the inner most band corresponds, to the surface-related signal. The thickness between them corresponds to the retinal thickness [9,10].

Visual acuity test is used to determine the smallest letters you can read on a standardized chart (Snellen's chart) or a card held 20 feet (6 meters) away [11].

Materials and Methods

A comparative retrospective cross sectional hospital based study was done in Khartoum state at Al Faisal Eye Center in period from October to December 2017. A written permission was obtained from ethics and review committee of University Eye Hospital-Alneelain University and informed consent was taken from every patient enrolled in the study.

102 patients (52 males/50 females) with diabetic macular edema were enrolled and only right eye (OD) was considered in this study. All were free from any systemic disease other than diabetes with macular edema. Best corrected visual acuity (BCVA) was measured by snelle's chart and pre and post treatment vision was compared after 6 month period in patients treated with 3 injections of avastin and lucentis and three laser applications.

Foveal thickness was measured by OCT with high-axial resolution (10 - 14 micrometer) cross-sectional imaging of the retina that directly measures optical reflectivity in the z-plane (depth of the retina). The collected data were analyzed by using IBM statistical package for social sciences SPSS version20.

Results

A total of 102 patients (102 eyes) were enrolled in this study in which 52 (50.9%) were males and 50 females (49.1%) (Table 1). Age range was (40 - 62) with mean age 55 ± 5.41 years. Mean vision before treatment was 0.21 ± 0.18 with range (0.02 - 0.6) and post treatment was 0.35 ± 0.26 with range (0.2 - 1) (Table 2 and figure 1). Mean values of central macular thickness (CMT) before and after treatment was 389 ± 127.8, range (223 - 669) and 238.1 ± 66.35, range (149 - 550) respectively (Table 3 and figure 2).

Treatment	Gender				Total	
	Male		Female			
	Frequency	%	Frequency	%	Frequency	%
IVL	15	14.7%	18	17.6%	33	32.3%
IVA	22	21.5%	20	19.6%	42	41.1%
Laser	15	14.7%	12	11.7%	27	26.4%
Total	52	50.9%	50	49.1%	102	100%

Table 1*: Distribution of gender according to type of treatment.*

	Pre-treatment		Post-treatment		
Treatment	P value	Range	Mean, SD	Range	Mean, SD
IVL	0.002*	0.02 - 1.00	0.30 ± 0.25	0.02 - 0.60	0.20 ± 0.16
IVA	0.001*	0.02 - 1.00	0.37 ± 0.26	0.02 - 0.60	0.18 ± 0.16
Laser	0.008*	0.02 - 1.00	0.38 ± 0.27	0.02 - 0.60	0.28 ± 0.20

Table 2: *Means, SD and range of vision according to the type of treatment.*
(*): Significant p value.

	Pre-treatment		Post-treatment		
Treatment	P value	Range	Mean, SD	Range	Mean, SD
IVL	0.001*	207 - 550	293.6 ± 72.7	223 - 660	403.6 ± 127
IVA	0.001*	149 - 442	276.1 ± 62.6	227 - 699	389.3 ± 134.2
Laser	0.001*	207 - 489	280.9 ± 64.3	238 - 602	370.1 ± 120.7

Table 3: *Means, SD and range of CMT according to the type of treatment.*
(*): Significant p value

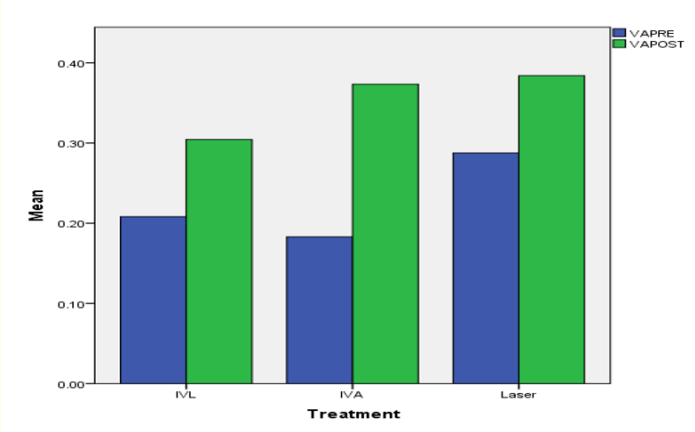

Figure 1: *Describes the comparison of VA mean according to types of treatment.*

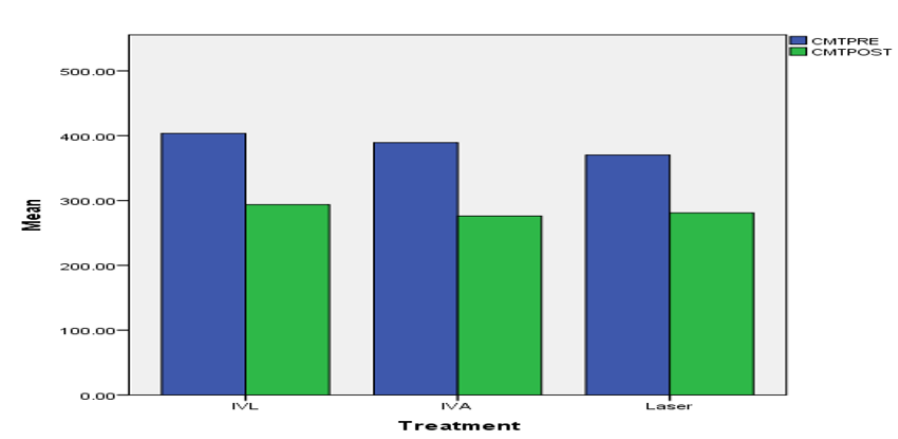

Figure 2: *Shows the comparison of CMT mean according to types of treatment.*

Independent sample t-test showed that there is no difference between mean of vision and central macular thickness (CMT) according to gender in association with the type of treatment $P > 0.05$.

In term of vision, there was a significant differences in vision between pre and post treatment when using paired sample t-test ($P < 0.001$). Also significant differences were found in all types of treatments IVL $P < 0.002$, IVA $P < 0.001$ and laser $P < 0.008$ (Table 2). On other hand, Pearson correlation showed that there is no relation between age and vision, CMT $P > 0.05$.

Regarding the macular thickness CMT, paired sample t-test revealed a significant differences between pre and post treatments ($P < 0.001$). Also, significant differences were found in all types of treatment ($P < 0.001$) (Table 3). On the other hand, the Pearson correlation showed that there is no relation between age and CMT $P > 0.05$.

Discussion

Diabetic macular edema treatments have changed in recent years after the introduction of intravitreal injections of anti-vascular endothelial growth factor (VEGF). These drugs are becoming more popular as the first line of treatments worldwide, but this also makes treatment more expensive. A combination of laser photocoagulation (LP) and drugs is being investigated to find out whether such treatments might be just as effective and reduce costs, since laser photocoagulation (LP) alone seems to have lost popularity [11]. In spite of this still lasers are being used for diabetic macular edema with positive results especially using the subthreshold photocoagulation including those which are poorly responding to anti VEGF and corticosteroids [12-14]. The number of intravitreal injections can be decreased with adjuvant use of laser photocoagulation [15].

The visual acuity changed according to the type of diabetic macular edema treatment. In present study it was found that IVA (bevacizumab) was more effective in improving the visual acuity mean amount in pre and post treatment, approximately 0.19 line in patients with diabetic macular edema and the same results were concluded by Heier., *et al.* 2006 who reported that patients with diabetic macular edema who were treated with IVA showed visual improvement in 12 weeks [11,16].

IVL (Ranibizumab) shows rapid improvement in vision and retinal anatomy in patients with diabetic macular edema [17]. Ranibizumab (Lucentis) is a humanized monoclonal antibody fragment developed specifically for use in the eye and it binds none selectively to and inhibits all isoforms of VEGF-A [7]. Avery 2006 [18] showed that IVL is not cost effective as compared to IVA although it is more effective,

however, in observational studies IVA appears to have similar efficacy. The recent study revealed that IVL treatment enhanced vision mean around 0.1 lines in diabetic macular edema patients but in long term follow up the improvement of vision becomes similar with the IVA.

Laser photocoagulation is a well-proven therapy to reduce the risk of vision loss from the diabetic macular edema but this need monitoring [19]. Our study showed that the improvement in vision mean changed to better by 0.1 lines and our findings agree with Research Group Arch Ophthalmol 1995 [16] who concluded that immediate laser treatment was effective in eyes with diabetic macular edema (DME).

Our findings found that's difficult to compare CMT in patients treated with IVA and IVL because both drugs show very promising results in reducing the macular edema [20]. The effects of both agents in the treated eyes of our patients support the previous studies in which IVA and IVL effectively reduced the CMT and improved the visual acuity in treated eye [21,22]. The laser treatment leads to reduce macular edema and this depend to the power and duration of laser treatment.

Conclusion

In conclusion, in our study Bevacizumab showed sustained improvements in vision and retinal anatomy in patients with diabetic macular edema than Ranibizumab and laser although both ranibizumab and bevacizumab are effective for the treatment of macular edema and both result in relatively equal anatomical and functional improvements. All three types lead to decrease central macular thickness and improve visual acuity.

Additional studies comparing anti-VEGF in the treatment of DME are necessary that compare the long-term efficacy and safety of different drugs.

Disclosure

There is no conflict of interest of any type in publishing this article. All the authors have read the article carefully and all the requirements of authorship criteria have been met.

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