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Evaluation of prophylactic intravitreal anti vascular endothelial growth factor (ranibizumab) injection for diabetic macular oedema after cataract surgery

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Abstract
Background/aim:
DM can result in many pathologies at different tissues in the human body especially eye structure, with both a systemic chronic metabolic disorders and a micro- angiopathic character.Cataract is one of the most common causes of visual impairment in patients with diabetes mellites . The aim of this study was to determine the feasibility and clinical effectiveness of intravitreal antivascular endothelial growth factor (Ranibizumab) combined with cataract surgery for prevention of the postoperative increase of retinal thickness in patients without diabetic maculopathy.
Material and methods: *40 eyes cataractous , with long standing type 2 diabetes mellitus(more than 10 years divided into 2 groups. Patients have underwent standard cataract surgery (phacoemulsification with intracular lens implantion), have been consecutively assigned in a 1:1 ratio to receive an intra vitreal injection of ranibizumab at the end of surgery or not (control group).*
Results:*The combination of intravitreal Ranibizumab and uncomplicated phacoemulsification avoids the increased macular thickening measured by OCT in mild to moderate diabetic retinopathy patients without previous macular involvement.*
Conclusion: *Although ranibizumab is effectine in the prevention of cystoid macular oedema in patients undergoing cataract surgery, Further studies with longer follow-up and larger groups are needed.*
Key words :*cataract, cystoid macular oedema, Diabetes mellites, HBA1C, ranibizumab,*
Significant statement: *This study confirmed that combined both intravitreal Ranibizumab and uncomplicated phacoemulsification is effective for prevention of the increased macular thickening measured by optical coherence tomography in mild to moderate diabetic retinopathy patients without previous macular involvement.*

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I. Introduction

Diabetes mellitus is defined as a group of disorders which is characterized by elevated blood glucose levelsdue to eitherdeficiency of insulin secretion or increased cellular resistance to the insulinactions, resulting in severe metabolic abnormalities affecting carbohydrates, fats and also proteins (1).
the International Diabetes Federation reported that increasingprevalence of diabetes mellitus (DM) which will be about 439 million DM patients by 2030 and will exceed 33% by 2050(2,3).
DM can result in many pathologies different tissues in the human body and eye structure(4).
Cataract is one of the most important causes of visual impairment in patients with diabetes up to five times especially at an early age(5,6,7).
studies have reported thatcataract is developed due to sorbitol accumulation leading to osmotic stress in the lens induces apoptosis in lens epithelial cells (LEC) (8, 9).
Modern phacoemulsification techniques are considered faster, safer, and more cost-effective than extracapsular or intracapsular cataract surgery used for diabetic patients (10).

Retinopathy can be progressed after cataract surgery according to The duration and complexity of the surgery (11).
Although modern phacoemulsification techniques are advanced, some studies have reported progression of diabetic retinopathy after phacoemulsification surgery; while others have reported no significant change(12) .
clinically significant macular edema after cataract surgeryis considered to be a predictor of poor final best corrected visual acuity in cases of uncomplicated phacoemulsification for Early Treatment Diabetic Retinopathy(13).
Pseudophakiccystoid macular edemais known as Irvine-Gass syndrome which is considered one of the most common causes of visual loss due to altered concentrations of angiogenic factorsafter cataract surgery (14,15).

II. Materials And Methods

This study was carried out in the department of ophthalmology Aswan university Hospital on 40 eyes cataractous , with long standing type 2 diabetes mellitus(more than 10 years).

Inclusion criteria:

1-age over 18 years and able to make decisions.
2-reduced visual acuity due to cataract with or without some degree of diabetic retinopahy without macular involvement).
3- All patients included were under glycemic control HbA1c less than 7%

Exclusion criteria:

Diabetic patients with previous diabetic macular oedema, other ocular pathology with macular involvement, uncontrolled hypertension, recent myocardial infarction , cerebral vascular accident, dense cataract obscure visualization and uncontrolled D.M. (HbA1C more than 7%) were excluded from the study. Written informed consent was obtained from each patient . Age, sex and duration of diabetes were recorded.
The subjects voluntarily agreed to participate in the study after the study's purpose and methods were explained.
All patients included in this study were subjected to the following:

Pre operative:

Routine general examination and investigation including fasting ,2hours post prandial blood glucose and HbA1c , blood pressure measurement.
Slit lamp biomicroscopic examination of the anterior and posterior segment .
Visual acuity with and without correction using snellen chart.
Goldman applanation tonometry for IOP measurement.
Measurement of the central foveal thickness by optical coherence tomography (3D OCT 2000 FA PLUS Topcon)retinal examination .
Fluroscein angiography to examine retinal periphery and evaluate severity of diabetic retinopathy(3D OCT 2000 FA PLUS Topcon).

Methods:

40 eyes have been divided into 2 groups:
Groups (a) : control group and group (b) : injection group in 1:1 ratio .
All phacoemulsification cataract surgeries were performed under local anesthesia by a single surgeon.
Patients have underwent standard cataract surgery (phacoemulsification with intracular lens implantion), have been consecutively assigned in a 1:1 ratio to receive an intra vitreal injection of ranibizumab at the end of surgery or not (control group).

Intra vitreal injection :

Each vial contains 2.3 mg of ranibizumab in 0.23 ml solution. This provides a usable amount to deliver a single dose of 0.05 ml containing 0.5 mg ranibizumab.
An intra vitreal injection of ranibizumab (0.05 mL of solution at 10mg / mL) at the end of surgery of ranibizumab injection group.
Site: 3.5 mm posterior to limbus , preferred at lower temporal region .
The angle of the needle injection through the sclera is directed in an oblique, tunneled fashion as rectangular radial entry may remain open, inducing vitreous or drug reflux under the conjunctiva, as well as severe chemosis and even hypotony .
The depth of the insertion may vary between 5 to 7 mm , so that the tip of the needle is placed in the mid-vitreous. The drug is then gently injected into the vitreous cavity.
Application of asponge at site of injection to prevent leakage of drug .
Iop check at the end of the procedure .

Application of antibiotic and steroid eye drops then ointment and eye patch .

Postoperative :

Postoperative treatment was identical for all the patients and has been consisted of the topical administration of antibiotic and steroid eye drops four timed a day for one month.

Complete ophthalomologic examination has been performed 1 and 3 months after cataract surgery by the same observer in all cases. The examination included :

slit lamp biomicroscopic examination of the anterior and posterior segment .

visual acuity with and without correction using snellen chart .

goldman applanation tonometry.

measurement of the central foveal thickness by optic coherence tomography(3D OCT 2000 FA PLUS Topcon)

retinal examination .

Briefly, all eyes underwent macular cube (512x128) scans with the OCT (optic coherence tomography) system The central subfield thickness has been calculated from the mean of three consecutive measurements. The data obtained in the control and Ranibizumab groups before , 1 and 3 months after surgery.

The main outcome measure is the CMT (central macular thickness) before , one and three months after surgery .

Statistical Analysis:

A statistical package program was used to evaluate the data obtained from the study. Data were verified, coded by the researcher and analyser using IBM-SPSS version-21.Descriptive statistics: Means, standard deviations, medians, ranges and percentages were calculated. chi-square test was used to compare the difference in distribution of frequencies among different groups.

Descriptive statistical methods (frequency, proportion, mean, and standard deviation) were used in the evaluation of research data as well as the Kolmogorov–Smirnov distribution test for examining normal distribution. In comparing quantitative data, independent t-test analysis was carried out to compare the means of normally distributed data. For categorical variables; done by Chi Square test (2 by 2 table). Linear regression models done to know significant predictors affecting on measuring central macular thickness at 2nd follow up after 3 months. The results were calculated at the 95% confidence interval, $P < 0.05$ significance level and $P < 0.01$ advanced significance level.

III. Results

40 eyes cataractous patients, with long standing type 2 diabetes mellitus(more than 10 year participated in the present study. They were selected from the department of ophthalmology Aswan university Hospital.No study participant left the research project for any reason. No side effects or complications were observed during the study. Baseline characteristics of the patients are shown in Table 1. Group A included 12 female patients and 8 male patients ranging from 55-68 years old .group B included 11 female patients and 9 male patients ranging from 60-70 years old.

There is a statistically significance difference between age in group A & group B by doing Independent T test($P < 0.05$). No statistically significance between gender in both groups($P > 0.05$), There is a statistically significant difference between both groups A & B regarding duration of DM($P < 0.05$), as shown in Table 1.

Independent T test shows that there are statistically significant difference between both groups A & B regarding measuring central macular thickness in first follow up after 1 month and 2nd follow up after 3 months. Repeated measure ANOVA shows that there is a statistically significant difference within group A and group B across time for perioperative, 1st follow up and 2nd follow up, as shown in Table 2.

There is correlation in group A between age & pre-operative, age with 1st follow up after 1 month, as shown in Table 3.

There is significant predictor is long duration of DM that are affecting on the outcome measuring central macular thickness, as shown in Table 4.

Linear regression analysis, outcome is measuring central macular thickness at 2nd follow up after 3 months in group AThere is no statistically significance predictors, as shown in Table 5.

linear regression analysis, outcome is central macular thickness at 2nd follow up after 3 months in the group BThere is no statistically significance predictors, as shown in Table 6.

ANCOVA analysis for showing statistically significance positive interactions between predictors on central macular thickness at 2nd follow up after 3 months in both groups A & B, as shown in Table 7

ANCOVA analysis for showing no interactions between predictors oncentral macular thickness at 2nd follow up after 3 months in the group A, as shown in Table 8

ANCOVA analysis for showing no interactions between predictors on central macular thickness at 2nd follow up after 3 months in the group B, as shown in Table 9

IV. Discussion

The present study is one of the most important studied that investigate the effectiveness of intra vitreal anti vascular endothelial growth factor injection in the prevention of macular oedema after phacoemulsification in both patients withorwithout mild diabetic retinopathy but without diabetic maculopathy.

However Massin et al., 2010 reported that Ranibizumab,a recombinant, humanized, monoclonal antibody Fab that neutralizes all active forms of VEGF-A, are effective treatment for diabetic macular oedema (16).

Previously, some studies did not confirm the effectiveness of Bevacizumab, a humanized monoclonal antibody that inhibits all isoforms of antivascular endothelial growth factor, in the macular thickening prevention after phacoemulsification (17).

Kim et al., 2007 concluded that 22% of diabetic patients developed increases of the center point thickness by >30% 4 weeks after uncomplicated phacoemulsification with clear differences of the present study of including patients with none diabetic retinopathy (18).

Muether et al. 2014 reported that intraocular ranibizumab is effective lasting for 33.7 ± 5.1 days (19).

Significant visual improvement and foveal thickness reduction were reported by Chen et al., 2009 after intraoperative bevacizumab injection in 15 patients (20).

Akinci et al. found similar results, but with adding grid laser photocoagulation at the first month postoperative (17).

The results of the current study disagree with Cheema et al., 2009 Who did not report any significant improvement during six months of follow-up. Though bevacizumab is still considered an off-label drug for the treatment of Diabetic macular edema although of its widely use all over the world (21)

According to DRCR network (Protocol Q), patients without preoperative DME are of low probability of developing central involved PME after cataract surgery. However, the presence of non-central DME immediately prior to cataract surgery or history of DME treatment ia considered a main cause for developing PME in such patients. (22).

ntravitreal bevacizumab during phacoemulsification is effective for improving best corrected visual acuity and decreasing macular thickness in patients had preexisting macular edema (20, 23).

There is no available study to compare between intravitreal bevacizumab and intravitreal ranibizumab used for the treatment of diabetic macular edema immediately after cataract surgery (24,25).

Intravitreal anti-vascular endothelial growth factor treatment is effective for reduction of macular thickness in some diabetic patients who must have cataract surgery (26, 27, 28, 29) .

Squirrell D, et al 2002 reported that uncomplicated cataract extraction using phacoemulsification have no effect on diabetic retinopathy progression (12).

Although, Squirrell et al 2002 have shown that patients have cataract surgery with elevated hemoglobin A1c have increased risk of the progression of diabetic retinopathy. These studies considered one eye that underwent phacoemulsification surgery and the other eye as a control. however, some studies that included patients with diabetes have phacoemulsification cataract surgery reported double progression rate of retinopathy at the 12 month period when compared to non operated eyes (13).

V. Conclusion

In summary, the combination of intravitreal Ranibizumab and uncomplicated phacoemulsification avoids the increased macular thickening measured by OCT in mild to moderate diabetic retinopathy patients without previous macular involvement.

Our study has some limitations. First, our sample size in each group is small and probably not large enough to elucidate the subtle differences between the two groups. Second, our follow-up period is short.

Although the small number of patients and the short follow up, the results seem to be promising with no increasing risk for the patient.

Further studies with longer follow-up and larger groups are needed to confirm the efficacy of RAN in the prevention of DME in patients undergoing cataract surgery.

In future, new treatments, such as other anti-VEGF agent injection and intravitreal anti-VEGF agents combined subtenon triamcinolone injection, should be investigated to improve clinical efficacy, and high-quality, large-scale, multicenter randomized control trials will be needed to verify.

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Table 1. Baseline characteristics of the patients.

	Group A (control group)	Group B (ranibizumab group)	P-value
Age (years, mean ± SD)	61.15 ± 3.15	63.8 ± 3.17	0.012*
Gender (male /females)	8 (40%)/ 12 (60%)	9 (45%)/11 (55%)	0.75
Duration of D.M.by years	10.75 ±0.72	10.8 ± 0.77	0.021*

Data are presented as mean ± SD. * p value is significant when <0.05.

Table 2. Comparison between both regarding to clinical data outcome.

	Group A (control group)	Group B (ranibizumab group)	P-value
Pre op.oct (baseline oct)	238.7 ± 12.38	240.15 ± 7.94	0.662
1st follow up after 1m	293.67 ± 67.12	258.45 ± 16.71	0.029*
2nd follow up after 3m	289.52 ± 51.04	260.6 ± 16.45	0.021*
p value for	< 0.023*	0.001*	0.021*

Data are presented as mean ± SD. * p value is significant when <0.05.

Table 3. Pearson correlation between age and clinical data in both groups.

	Group A (control group)	Group B (ranibizumab group)
Age with Duration of D.M.	r value 0.11 p value 0.64	r value 0.22 p value 0.35
Age with Pre op.oct (baseline oct)	r value -0.07 p value 0.76	r value -0.06 p value 0.79
Age with 1st follow up after 1m	r value 0.54 p value 0.015*	r value -0.24 p value 0.31
Age with 2nd follow up after 3m	r value -0.28 p value 0.24	r value -0.24 p value 0.31

Data are presented as mean ± SD. * p value is significant when <0.05.

Table 4: linear regression analysis, outcome is measuring central macular thickness at 2nd follow up after 3 months for both groups.

	B value	P-value
Age	-4.854	.010*
Sex	8.564	.479
Duration of DM	17.648	.039*

* p value is significant when <0.05.

Table 5:linear regression analysis, outcome is measuring central macular thickness at 2nd follow up after 3 months in group A.

	B value	P-value
Age	1.164	.691
Sex	17.328	.267
Duration of DM	17.347	.081

* p value is significant when <0.05.
There is no statistically significance predictors .

Table 6: linear regression analysis, outcome is central macular thickness at 2nd follow up after 3 months in the group B.

	B value	P-value
Age	-1.351	.333
Sex	-1.745	.835
Duration of DM	.248	.963

* p value is significant when <0.05.
There is no statistically significance predictors .

Table 7: Univariate analysis between personal and clinical predictors on central macular thickness at 2nd follow up after 3 months in all patients.

Source	Mean Square	p value
Sex	11258.513	.001
Duration of DM	6761.363	.009
Age	7645.095	.006
Sex * duration of DM	11402.763	.001
Sex * age	11366.233	.001
Duration of DM * age	7170.401	.008
Sex * duration of DM * age	11567.822	.001

*pvalue is significant when <0.05.

Table 8 : Univariate analysis between personal and clinical predictors on central macular thickness at 2nd follow up after 3 months in the group A.

Source	Mean Square	p value
Sex	771.200	.354
Duration of DM	665.814	.388
Age	605.538	.410
Sex * duration of DM	694.544	.378
Sex * age	723.504	.369
Duration of DM * age	624.588	.402
Sex * duration of DM * age	651.835	.393

* p value is significant when <0.05.

Table 9: Univariate analysis between personal and clinical predictors on central macular thickness at 2nd follow up after 3 months in the group B.

Source	Mean Square	p value
Sex	164.735	.503
Duration of DM	189.259	.474
Age	168.715	.498
Sex * duration of DM	130.616	.551
Sex * age	156.741	.514
Duration of DM * age	193.966	.469
Sex * duration of DM * age	123.225	.562

* p value is significant when <0.05.

References

[1]. Das, M.; Upadhyaya, V.; Ramachandra, S.S. and Jithendra, K.D. Periodontal treatment needs in diabetic and non-diabetic individuals: a case-control study. Indian J. Dent. Res.2011, 22 (2): 291-294.

[2]. International Diabetes Federation. IDF Diabetes Atlas 7th Edition. Brussels, Belgium. 2015.

[3]. Boyle JP, Thompson TJ, Gregg EW, Barker LE, Williamson DF. Projection of the year 2050 burden of diabetes in the US adult population: dynamic modeling of incidence, mortality, and prediabetes prevalence. Popul Health Metr. 2010, 8:29.

[4]. Skarbez K, Priestley Y, Hoepf M, Koevary SB. Comprehensive Review of the Effects of Diabetes on Ocular Health. Expert Rev Ophthalmol. 2010, 5:557–577.

[5]. Drinkwater JJ, Davis WA, Davis TME. A systematic review of risk factors for cataract in type 2 diabetes. Diabetes Metab Res Rev. 2019, 35:3073.

[6]. Saxena S, Mitchell P, Rochtchina E. Five-year incidence of cataract in older persons with diabetes and pre-diabetes. Ophthalmic Epidemiol. 2004, 11:271–277.

[7]. Javadi MA, Zarei-Ghanavati S. Cataracts in diabetic patients: a review article. J Ophthalmic Vis Res. 2008, 3:52–65.

[8]. Srivastava S. K. , Ramana K. V. , and Bhatnagar A. , "Role of aldose reductase and oxidative damage in diabetes and the consequent potential for therapeutic options," Endocrine Reviews. 2005,vol. 26, no. 3, pp. 380–392.

[9]. Takamura Y. , Sugimoto Y. , Kubo E. ,Takahashi Y. , and Akagi Y. . Immunohistochemicalstudy of apoptosis of lens epithelial cells in human and diabetic rat cataracts," Japanese Journal of Ophthalmology. 2001, vol. 45, no. 6, pp. 559–563.

[10]. Mozaffarieh M, Heinzl H, Sacu S, Wedrich A. Clinical outcomes of phacoemulsification cataract surgery in diabetes patients: visual function (VF-14), visual acuity and patient satisfaction. ActaOphthalmol Scand. 2005, 83:176–183.

[11]. Mittra RA, Borrillo JL, Dev S, Mieler WF, Koenig SB. Retinopathy progression and visual outcomes after phacoemulsification in patients with diabetes mellitus. Arch Ophthalmol. 2000, 118:912–917.

[12]. Squirrell D, Bhola R, Bush J, Winder S, Talbot JF. A prospective, case controlled study of the natural history of diabetic retinopathy and maculopathy after uncomplicated phacoemulsification cataract surgery in patients with type 2 diabetes. Br J Ophthalmol. 2002, 86:565–571.

[13]. Hong T, Mitchell P, de Loryn T, Rochtchina E, Cugati S, Wang JJ. Development and progression of diabetic retinopathy 12 months after phacoemulsification cataract surgery. Ophthalmology. 2009, 116:1510–1514.

[14]. Yonekawa Y, Kim IK. Pseudophakic cystoid macular edema. CurrOpinOphthalmol. 2012, 23:26–32.

[15]. Patel J. I., Hykin P. G., Cree I. A. Diabetic cataract removal: postoperative progression of maculopathy-growth factor and clinical analysis. British Journal of Ophthalmology .2006 , 90(6) : 697–701.

[16]. Massin P., Bandello F., Garweg J. G., et al. Safety and efficacy of ranibizumab in diabetic macular edema (RESOLVE study): a 12-month, randomized, controlled, double-masked, multicenter phase II study. Diabetes Care. 2010, 33(11):2399–2405.

[17]. Akinci A., Batman C., Ozkilic E., and Altinsoy A., "Pha-coemulsification with intravitreal bevacizumab injection indiabetic patients with macular edema and cataract,"Retina. 2009, vol. 29, no. 10, pp. 1432–1435.
[18]. Kim SJ, Equi R, Bressler NM. Analysis of macular edema after cataract surgery in patients with diabetes using optical coherence tomography. Ophthalmology. 2007, 114(5):881–889.
[19]. Muether P. S., Droege K. M., Fauser S. Vascular endothelial growth factor suppression times in patients with diabetic macular oedema treated with ranibizumab. British Journal of Ophthalmology. 2014, 98(2):179–181.
[20]. Chen C.H., Liu Y.C., Wu P.C. The combination of intravitreal bevacizumab and phacoemulsification surgery in patients with cataract and coexisting diabetic macular edema. J OculPharmacolTherapeut. 2009;25(1):83–89.
[21]. Cheema R.A., Al-Mubarak M.M., Amin Y.M., Cheema M.A. Role of combined cataract surgery and intravitreal bevacizumab injection in preventing progression of diabetic retinopathy: prospective randomized study. J Cataract Refract Surg. 2009, 35(1):18–25.
[22]. Diabetic Retinopathy Clinical Research Network Authors/Writing Committee. Baker CW, Almukhtar T, Bressler NM, Glassman AR, Grover S, Kim SJ, Murtha TJ, Rauser ME, Stockdale C. Macular edema after cataract surgery in eyes without preoperative central-involved diabetic macular edema. JAMA Ophthalmol. 2013, 131:870–879.
[23]. Lanzagorta-Aresti A, Palacios-Pozo E, MenezoRozalen JL, Navea-Tejerina A. Prevention of vision loss after cataract surgery in diabetic macular edema with intravitreal bevacizumab: a pilot study. Retina. 2009, 29(4):530–535.
[24]. Nepomuceno A.B., Takaki E., Paes de Almeida F.P. A prospective randomized trial of intravitreal bevacizumab versus ranibizumab for the management of diabetic macular edema. Am J Ophthalmol. 2013, 156(3) 502-10 .
[25]. Wiley H. E., Thompson D. J. S., Bailey C., et al. A crossover design for comparative efficacy . Ophthalmology . 2016, 123 (4) :841–849.
[26]. Lim L.L., Morrison J.L., Constantinou M., Rogers S., Sandhu S.S., Wickremasinghe S.S., Kawasaki R., Al-Qureshi S. Diabetic Macular Edema at the Time of Cataract Surgery Trial: A Prospective, Randomized Clinical Trial of Intravitreous Bevacizumab versus Triamcinolone in Patients with Diabetic Macular Oedema at the Time of Cataract Surgery—Preliminary 6 Month Results. Clin. Exp. Ophthalmol. 2016, 44:233–242.
[27]. Isaac D. L. C., Abud M. B., Frantz K. A., Rassi A. R., Avila M. Comparing intravitreal triamcinolone acetonide and bevacizumab injections for the treatment of diabetic macular oedema: a randomized double-blind study. Acta Ophthalmologica.2012, 90(1):56–60.
[28]. Sobaci G., Özge G., Erdurman C., Durukan H. A., Bayraktar Z. M. Comparison of grid laser, intravitreal triamcinolone, and intravitreal Bevacizumab in the treatment of diffuse diabetic macular edema. Ophthalmologica. 2012, 227(2):95–99.
[29]. Sze A. M., Luk F. O., Yip T. P., Lee G. K., Chan C. K. Use of intravitreal dexamethasone implant in patients with cataract and macular edema undergoing phacoemulsification. European Journal of Ophthalmology. 2015, 25(2):168–172.

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