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EVALUATION OF CLINICAL OUTCOMES IN RETINAL VEIN OCCLUSION

Ophthalomology

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ABSTRACT

Introduction: Retinal vein occlusion (RVO) is the most common retinal vascular disease after diabetic retinopathy.**Aim:** To evaluate the role of Optical Coherence Tomography (OCT) in cases of Retinal vein occlusion (both central retinal vein occlusion (CRVO) and branch retinal vein occlusion (BRVO) and to study the natural course of disease and efficacy of various modalities of treatment.**Material & Methods:** It is a Prospective study. This study included 53 eyes of 52 patients of retinal vein occlusion. 12 eyes of 12 patients had CRVO and 41 eyes of 40 patients had BRVO. All patients undergone different treatment and were followed for 6 months and their visual acuity for distance and near was monitored at each follow up (1,2, 3 and 6 months). The baseline and follow up OCT was also done for all patients. The visual outcome was assessed in terms of the change in the visual acuity for distance and near at each follow up and corresponding change in central macular thickness as measured on OCT. **Result :** Change in the BCVA in decimals of the patients after treatment was observed at each follow up and corresponding central macular thickness was measured on OCT. There was a strong negative correlation between visual acuity and the central macular thickness. **Conclusion:** OCT is an important tool in monitoring the progression of the macular edema in retinal vein occlusion and response to the treatment.

KEYWORDS

Central Retinal Vein Occlusion (CRVO), Branch Retinal Vein Occlusion (BRVO), Optical Coherence Tomography (OCT)

INTRODUCTION :

Retinal vein occlusion (RVO) is the most common retinal vascular disease after diabetic retinopathy.(1)Several risk factors have been associated with central retinal vein occlusion (CRVO) and branch retinal vein occlusion (BRVO), including age, hypertension, atherosclerotic retinal vessel changes, diabetes, hyperhomocysteinaemia and open-angle glaucoma.(1–4)

In the early stages of CRVO, there are scattered hemorrhages throughout the entire retina, cotton wool patches, a sign of retinal ischemia, and massive edema of the retina. This picture occurs from thrombosis within the central retinal vein causing partial obstruction of blood flow from the eye, increased intraluminal pressure in the retinal veins, and increased transudation of blood and plasma into the retina. The subacute stage varies among patients depending primarily upon the amount of retinal ischemia, and patients are classified as ischemic or nonischemic. Severe retinal ischemia can be complicated by retinal neovascularization, iris neovascularization, neovascular glaucoma, and a very poor visual outcome. Thus the amount of retinal ischemia is one of the major determinants of outcome.

BRVO mainly occurs at the arterio–venous crossings. Retinal artery and vein share a common adventitial sheath at the crossing site. This sheath may predispose this site to BRVO.(5) At the arterio-venous crossing there is varying degrees of fusion of the vascular wall.(6)Venous compression by the relatively rigid artery may result in turbulent flow, endothelial damage, thrombosis and occlusion.(7) It has been observed that two third of occlusions develop superotemporally and one third develops inferotemporally.(8)The predilection of BRVO for superotemporal quadrant was caused by greater number of AV crossings in this quadrant.The most common sequel of RVO is the development of cystoid macular edema (CME) with a consecutive deterioration in vision. The major stimulus for the formation of macular oedema and neovascularisation in patients with RVO seems to be hypoxia-induced production of vascular endothelial growth factor (VEGF), an angiogenic factor that promotes angiogenesis and increases permeability.(9)

In RVO, fluoroscein angiography helps in determining retinal perfusion status and amount of capillary non-perfusion areas as well as macular perfusion.

Optical Coherence Tomography (OCT) offers high resolution cross sectional images of the retina and quantitative measurement of the central macular thickness in macular edema secondary to RVO and also helps to know any concomitant pathology viz; epiretinal membrane, vitreo-macular traction etc.

Many modalities of treatment have been studied in RVO including laser photocoagulation, intravitreal triamcinolone, intravitreal anti – VEGFs etc. However, according to the Branch Vein Occlusion Study, only patients with macular oedema associated with BRVO and a visual acuity of 20/40 or less showed a significant visual benefit compared with the untreated control group.(10) In patients with macular oedema secondary to CRVO, there was no difference between eyes treated with macular grid laser photocoagulation and observation only.(11) Several studies have evaluated the efficacy of intravitreal triamcinolone in the treatment of macular oedema secondary to both BRVO and CRVO, but were only able to show stabilisation or a moderate improvement in visual acuity.(12-14) However, the main limitation of intravitreal triamcinolone therapy is the high rate of side effects, such as cataract formation or increased intraocular pressure. An alternative for patients with macular oedema secondary to RVO is antiVEGF therapy. Anti VEGFs include Bevacizumab, Ranibizumab and Pegaptanib. Ranibizumab and Pegaptanib has been approved for intraocular use.
The present study was undertaken to evaluate the clinical outcomes in retinal vein occlusion.

MATERIAL AND METHODS :

This was a prospective study conducted at the Ophthalmology department of a tertiary hospital in Pune after ethical committee approval. The study was conducted on 52 patients attending the Retina clinic from August 2008 to June 2010. This study included 53 eyes of 52 patients of retinal vein occlusion. 12 eyes had CRVO and 41 eyes had BRVO. The data has been analysed by using Minitab 15.0 and SPSS (Statistical package for social science) 17.0 statistical software and MS-Excel . To find out the significance between various parameters we have used paired t-test, Unpaired t-test, correlations, scatter plots for macular thickness and BCVA, Tuckey's test etc. at 95% confidence interval (5% level of significance).

Inclusion criteria :

1. Newly diagnosed cases of RVO with no prior history of treatment for the same.

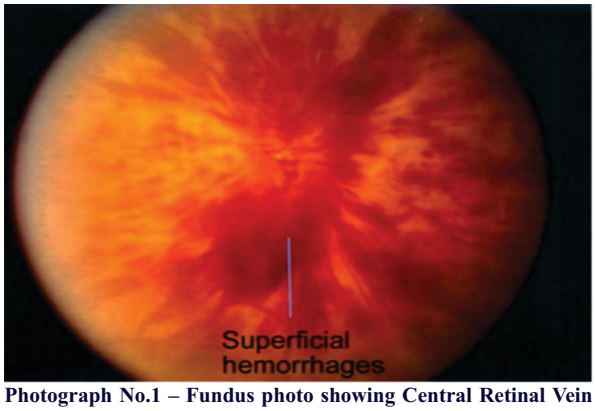
2. Macular edema secondary to RVO

Exclusion criteria :
1. Opaque media.

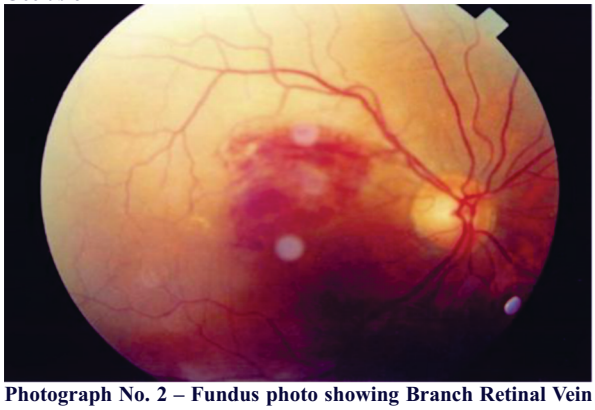
2. Any other ocular pathology that could account for macular edema likediabetic retinopathy, age related macular degeneration, uveitis, post-ocular surgery etc.

A detailed history of patient was taken noting the ocular complaints, their duration,associated systemic illnesses including diabetes, hypertension etc, and family history for any hereditary diseases, past history of any ocular disease or any medications.General examination included pulse and blood pressure measurement and peripheral pulses. A thorough ocular examination was done in which the best corrected visual acuity (BCVA) was recorded on the Snellen's chart for distance and on Roman test chart for near. The anterior segment was examined by the slit lamp biomicroscopy giving special attention to pupillary reactions and neovascularization of iris. The dilated fundus examination was done by the slit lamp biomicroscopy using a +90D lens and by indirect ophthalmoscopy. The intraocular pressure(IOP) was measured by Goldman's applanation tonometer(AT). Gonioscopy was done where necessary.

Ocular investigations like Fundus Fluoroscein Angiography (FFA) and Optical Coherence Tomography (OCT) were done.



Photograph No.1 – Fundus photo showing Central Retinal Vein Occlusion



Photograph No. 2 – Fundus photo showing Branch Retinal Vein Occlusion

Optical Coherence Tomography:
OCT was done using the Zeiss Stratus OCT scanners (Carl Zeiss Meditech, Inc, Dublin, California) after dilating pupils in every patient using macular cube 512 × 128 and macular thickness was noted. The central macular thickness was defined as the distance between the innermost foveolar surface and the outermost foveolar surface and was measured using the manually assisted technique of the program with the OCT system software, with the fixation point regarded as the foveal centre.OCT was done again at 1,2,3 and 6 months of follow-up.

Fundus Fluoroscein Angiography:
FFA was done on all patients. It was done when the initial hemorrhages were resolved.

Following treatment modalities were used:

Lasers: Argon lasers were used. A written informed consent was taken explaining the risks and benefits of lasers and possible complications.Pan retinal photocoagulation: It was done in cases of Ischemic CRVO (atleast 10 disc diameter area of capillary non perfusion) with atleast 1 area of neovascularization at iris or angle or in retina (at disc or periphery). 2000 - 3000 shots were given of size 200 – 300 microns in divided sittings.

Macular grid laser: It was done in cases of BRVO with macular edema wherein macular perfusion was normal on FFA. On an average 100shots of 100 microns sizes were given. Follow up was done at 1,2,3 & 6 months.

Intravitreal injections:
A written informed consent was taken before the procedure. Patient was followed up next day, then after 1 week, and 1,2,3 & 6 months thereafter.

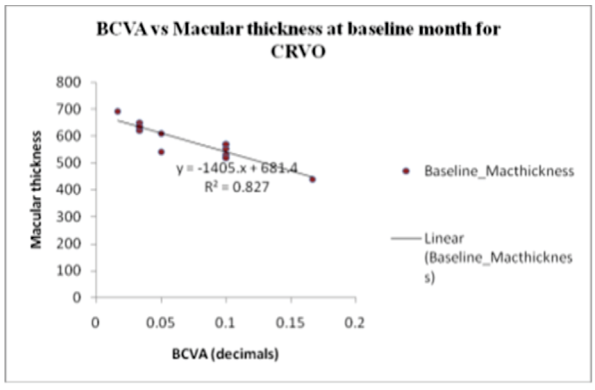
Dosage:
Intravitreal Triamcinolone Acetonide (IVTA) – 0.1 ml of 4 mg
Intravitreal Bevacizumab (Avastin) (IVB) – 0.05 ml of 2.5 mg

Follow – up:
For patients who opted no treatment were followed up at 1,2,3 & 6 months.

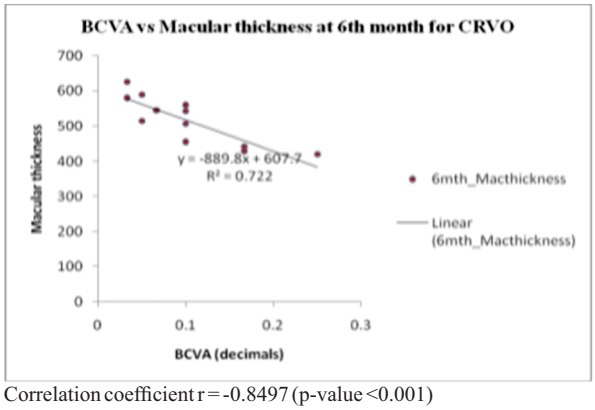
At every follow up patient's BCVA was checked for distance and near, slit lamp examination was done. IOP was measured with AT. Dilated fundus examination was done & OCT was done for macular thickness (Macular cube 512×128).

RESULTS:
STATISTICAL ANALYSIS FOR CRVO (N=12) PATIENTS:

Figure 1: Scatter plots and correlation coefficient between BCVA and Macular thickness
a) At baseline



Correlation coefficient r = -0.9097 (p-value <0.001)
b) At 6th month



Correlation coefficient r = -0.8497 (p-value <0.001)

CONCLUSION: -
There is significantly strong negative correlation between the BCVA (decimals) and Macular thickness with respect to CRVO patients at Baseline and 6th month. This indicates that as macular thickness decreases vision increases and vice versa.

Table No.1 - Treatment wise comparison of mean BCVA (decimals) at baseline and 1st, 2nd, 3rd & 6th month in CRVO patient

Type of treatment	Baseline	1st month	2nd month	3rd month	6th month
Natural course (n=2)	0.13 ± 0.05	0.13 ± 0.05	0.08 ± 0.04	0.08 ± 0.04	0.07 ± 0.05
IVTA (n= 4)	0.08 ± 0.03	0.15 ± 0.03	0.15 ± 0.07	0.12 ± 0.03	0.12 ± 0.09
Bevacizumab (n= 4)	0.05 ± 0.04	0.10 ± 0.05	0.12 ± 0.06	0.17 ± 0.10	0.12 ± 0.06
Laser (n= 2)	0.04 ± 0.01	0.04 ± 0.01	0.03 ± 0.00	0.05 ± 0.00	0.06 ± 0.01

As the sample size is small statistical significance could not be achieved.

Table No. 2- Treatment wise comparison of Mean Macular thickness (in microns) at baseline and 1st,2nd,3rd & 6th month in CRVO patients.

Type of treatment	Baseline	1st month	2nd month	3rd month	6th month
Natural course (n=2)	485.50 ± 64.35	512.50 ± 38.89	522.50 ± 48.79	537.00 ± 52.33	561.50 ± 26.16
IVTA (n= 4)	566.50 ± 42.47	482.75 ± 31.28	471.00 ± 27.14	495.00 ± 57.88	515.00 ± 94.43
Bevacizumab (n= 4)	626.75 ± 51.08	537.75 ± 41.37	514.00 ± 49.01	491.25 ± 72.19	491.75 ± 73.26
Laser (n= 2)	596.00 ± 76.37	596.5 ± 00.71	624.50 ± 13.44	583.0 ± 00.00	530.00 ± 21.21

Table No. 3- Table showing percentage of eyes (No. of eyes) improved or deteriorated on Snellen's chart for distance vision over 6 months in patients with CRVO

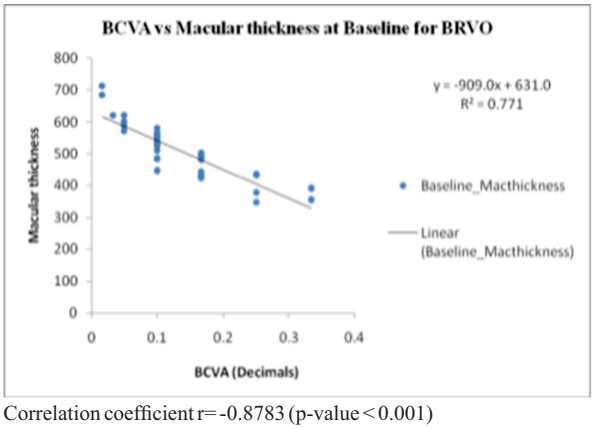
	Change in visual acuity for distance over 6 months	Percentage of eyes			
		Natural course n=2	IVTA (n=4)	Bevacizumab (n=4)	Laser (n=2)
Improvement	> 2 lines	-	25%(1)	50%(2)	-
	2 lines	-	25%(1)	25%(1)	50%(1)
	1 line	-	-	25%(1)	-
	No change	-	25%(1)	-	50%(1)
Deterioration	1 line	50% (1)	-	-	-
	2 lines	50% (1)	-	-	-
	> 2 lines	-	25%(1)	-	-

Number in the bracket indicates number of eyes

STATISTICAL ANALYSIS FOR BRVO (N=40) PATIENTS AND TOTAL NUMBER OF EYES 41, ONE PATIENT HAVING BILATERAL BRVO.

Figure 2-Scatter plots and correlation coefficient between BCVA and Macular thickness

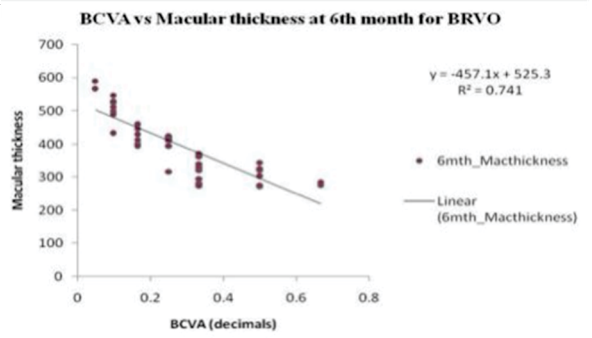
a.. At Baseline



Correlation coefficient r= -0.8783 (p-value < 0.001)

CONCLUSION: -

There is significantly strong negative correlation between the BCVA (decimals) and Macular thickness with respect to BRVO patients at Baseline and 6th month in BRVO patients. This indicates that as macular thickness decreases vision increases and vice versa.



Correlation coefficients r = -0.861 (p-value < 0.001)

Table No. 4- Treatment wise comparison of mean BCVA (decimals) at baseline and 1st, 2nd,3rd &6th month in BRVO patients.

	Baseline	1st month	2nd month	3rd month	6th month
Natural course	0.12 ± 0.05	0.14 ± 0.06	0.15 ± 0.06	0.19 ± 0.09	0.19 ± 0.09
p-value		0.557	0.43	0.091	0.091
IVTA	0.17 ± 0.09	0.29 ± 0.16	0.26 ± 0.07	0.30 ± 0.13	0.31 ± 0.15
p-value		0.031*	0.006*	0.037*	0.019*
Bevacizumab	0.15 ± 0.10	0.35 ± 0.23	0.32 ± 0.21	0.32 ± 0.21	0.32 ± 0.21
p-value		0.007*	0.007*	0.007*	0.007*
Laser	0.16 ± 0.08	0.19 ± 0.07	0.18 ± 0.08	0.21 ± 0.10	0.26 ± 0.16
p-value		0.131	0.168	0.042*	0.009*
IVTA+Laser	0.09 ± 0.06	0.16 ± 0.09	0.19 ± 0.12	0.21 ± 0.13	0.26 ± 0.17
p-value		0.029*	0.049*	0.028*	0.047*
Bevacizumab +Laser	0.09 ± 0.06	0.19 ± 0.14	0.21 ± 0.12	0.30 ± 0.19	0.37 ± 0.28
p-value		0.057	0.026*	0.035*	0.054

Significant

CONCLUSION: -

By using paired t-test there is significant difference between baseline and 1st, 2nd, 3rd and 6th month BCVA with respect to the treatment IVTA, Bevacizumab, Laser, IVTA+ Laser, Bevacizumab + Laser.

Table No. 5- Treatment wise comparison of Mean Macular thickness at baseline and 1st, 2nd, 3rd & 6th month in BRVO patients

	Baseline	1st month	2nd month	3rd month	6th month
Natural course	479.33 ± 78.05	445.67 ± 55.36	431.33 ± 49.18	400.17 ± 48.33	399.33 ± 72.76
p-value		0.128	0.194	0.052	0.066
IVTA	433.00 ± 64.14	359.57 ± 64.59	360.14 ± 53.99	354.29 ± 74.60	337.86 ± 96.29
p-value		0.004*	0.005*	0.011*	0.015*
Bevacizumab	508.63 ± 71.39	406.75 ± 92.46	388.00 ± 93.48	405.13 ± 98.94	407.13 ± 98.42
p-value		< 0.001*	< 0.001*	0.001*	0.001*
Macular grid	498.00 ± 61.20	458.40 ± 41.95	443.00 ± 61.90	429.60 ± 80.74	423.00 ± 94.52
p-value		0.002*	0.003*	0.003*	0.005*
IVTA+Laser	595.80 ± 77.60	493.80 ± 81.48	469.00 ± 89.31	445.00 ± 81.09	429.60 ± 92.85
p-value		0.001*	0.002*	< 0.001*	0.002*
Bevacizumab+ Laser	561.60 ± 86.85	478.20 ± 102.38	358.80 ± 200.49	409.80 ± 94.02	380.00 ± 99.73
p-value		0.014*	0.056*	0.007*	0.002*

Significant

CONCLUSION :-

By using paired t-test there is significant difference between baseline and 1st, 2nd, 3rd and 6th month macular thickness with respect to the treatments IVTA, Bevacizumab, Laser, IVTA + Laser, Bevacizumab + Laser.

Table No. 6- Table showing percentage of eyes (No. of eyes) improved or deteriorated on Snellen's charts for distance vision over 6 months in patients with BRVO.

	Change in visual acuity for distance over 6 months	Percentage of eyes					
		Natural course n=6	IVTA (n=7)	Bevaciz-umab (n=8)	Laser (n=10)	IVTA + Laser (n=5)	Bevacizumab + Laser (n=5)
Improvement	> 2 lines	16.66%(1)	28.57%(2)	37.5%(3)	-	100%(5)	80%(4)
	2 lines	16.66%(1)	-	37.5%(3)	40%(4)	-	-
	1 line	16.66%(1)	57.14%(4)	25%(2)	30%(3)	-	20%(1)
	No change	50%(3)	14.28%(1)	-	20%(2)	-	-
Deterioration	1 line	-	-	-	-	-	-
	2 lines	-	-	-	10%(1)	-	-
	> 2 lines	-	-	-	-	-	-

Number in the bracket indicates number of eyes.

DISCUSSION :

The present study included 52 patients of retinal vein occlusion.12 patients (23.08%) had CRVO and 40 patients (76.92%) had BRVO.

Central Retinal Vein Occlusion (CRVO) :

There were 12 eyes of 12 patients with CRVO, all cases were unilateral. There were 12 patients of CRVO, 6 males (50%) and 6 females (50%). Of the 12 patients, 2 patients (16.67%) had no treatment and were observed, 4 patients (33.33%) had IVTA, 4 patients (33.33%) had intravitreal Bevacizumab and 2 patients (16.67%) had laser photocoagulation (Pan Retinal Photocoagulation).

1 – Natural course in CRVO :

As is evident from the table 1 the mean BCVA went on decreasing through 6 months. The mean BCVA at 6 months was less as compared to baseline, thus there was deterioration of mean BCVA at 6 months. As the sample size is small (n=2), no statistical significance could be achieved.Also as seen in table 2, the mean macular thickness went on increasing through 6 months follow up. The mean macular thickness was more at the end of 6 months compared to baseline. This shows that there is increase inmacular thickness through 6 months. As the sample size is small(n=2), statistical significance could not be achieved.Also from table 3, for distant vision on Snellen's chart, at the end of 6 months, 1 patient (50%) had deterioration of 2 or more lines and 1 patient (50%) had deterioration of 1 line.Therefore in natural course of CRVO, the vision goes on decreasing and macular thickness goes on increasing through 6 months follow up. This corroborates with exhaustive systematic review by Rachel L. McIntosh and group.172 In present study as the sample size is small (n=2), statistical significance could not be achieved.

2 – Intravitreal Triamcinolone (IVTA) :

There were 4 patients of CRVO who had IVTA. As is evident from table 1, mean BCVA in decimals increased in 1st month after IVTA, remained stable in 2nd month and decreased slightly in 3rd month and remained stable until 6th month. The mean BCVA in decimals at 6 months was more than the baseline. This shows that there is gain in mean BCVA at 6 months but the gain is more in 1st and 2nd month and then visual acuity decreases slightly and remains stable at the end of 6 months. As the sample size is small (n=4), no statistical significance could be achieved.As seen in table 2, mean macular thickness decreased in 1stand 2nd month, slightly increased in 3rd and 6th month but mean macular thickness at 6th month was less than mean macular thickness at baseline.This shows that there is reduction in mean macular thickness at 6 months, but the reduction is more in 1st and 2nd month and then the macular thickness increases in 3rd and 6th month. As the sample size is low (n=4), no statistical significance could be achieved.Also from table 3 ,for distant vision on Snellen's chart , at the end of 6 months, 1 patients (25%) improved by more than 2lines, 1 patient (25%) improved by 2 lines, 1 patients (25%) vision remained the same and 1 patient (25%) deteriorated by 2 or more lines.

3 – Intravitreal Bevacizumab :

There were 4 patients of CRVO who had Intravitreal Bevacizumab. As is evident from table 1, mean BCVA in decimals increased through 1st, 2nd and 3rd month after Intravitreal Bevacizumab and decreased at 6th month follow up. The mean BCVA in decimals at 6th month was more than the baseline. This shows that there is gain in mean BCVA at 6 months but the gain is more in 1st, 2nd and 3rdmonth and then visual acuity decreases slightly at the end of 6 months. As the sample size is small (n=4), no statistical significance could be achieved. As seen in table 2, mean macular thickness decreased in 1st, 2nd and 3rd month and remained stable upto 6th month. Mean macular thickness at 6th month was less than mean macular thickness at baseline.This shows that there is reduction in macular thickness at 6 months, but the reduction is more in 1st, 2nd and 3rd month and then the macular thickness remains stable upto 6th month. As the sample size is small (n=4), no statistical significance could be achieved. As seen in table 3 , for distant vision on Snellen's chart , at the end of 6 months, 2 patients (50%) improved by more than 2 lines, while as 1 patient (25%) improved by 2 lines and 1 patient improved by 1 line.

4 – Laser photocoagulation (Pan retinal photocoagulation) :

There were 2 patients of CRVO who had pan retinal photocoagulation. As is evident from table 1, mean visual acuity in decimals remained the same for baseline and 1st month, decreased a bit in 2nd month and again increased in 3rd and 6th month. The mean final visual acuity in decimals at 6 months was more than the baseline. This shows that there is gain in mean BCVA at 6 months but the gain is very minimal. As the sample size is too small (n=2), no statistical significance could be achieved. As seen in table 2, mean macular thickness remained the same at baseline and 1st month, increased in 2nd month and again decreased in 3rdand 6th month. This shows that there is reduction in mean macular thickness at 6 months but the reduction is minimal. As the sample size is too small(n=2), no statistical significance could be achieved. As seen in table 3, for distant vision on Snellen's chart, at the end of 6 months 1 patient (50%) improved by 2 or more lines for distance, while as in 1 patient (50%) vision remained the same.

Branch Retinal Vein Occlusion (BRVO) :

There were 40 patients of BRVO, 22 males (55%) and 18 females (45%).1 patient had bilateral BRVO, so in all, 41 eyes of 40 patients with BRVO. Of the 41 eyes, 6 eyes (14.63%) had no treatment and were observed,7 eyes(17.07%) had IVTA, 8 eyes (19.51%) had intravitreal Bevacizumab and 10 eyes (24.39%) had macular grid laser, 5 eyes (12,20%) had IVTA and macular grid laser and 5 eyes (12.20%) had intravitreal Bevacizumab and macular grid laser.1- Natural course in BRVO :

As is evident from the table 4, the mean BCVA in decimals went on increasing through 1st, 2nd & 3rdmonth and remained the same upto 6 months. The mean BCVA in decimals at 6 months was more than the baseline, thus there was a gain in mean BCVA after 6 months, but the gain was not statistically significant ($p>0.05$). As seen in table 5, mean macular thickness went on decreasing through 1st, 2nd, 3rd & 6 months. The mean macular thickness at 6 months was less than the baseline. Thus there was decrease in mean macular thickness through 6 months of follow up, but this decrease was not statistically significant ($p>0.05$). As seen in table 6, for distant vision on Snellen's chart, at the end of 6 months, of 6 eyes of 5 patients who had no treatment,1eye (16.66%) improved by more than 2 lines, 1 eye (16.66%) improved by 2 lines, 1 eye(16.66%) improved by 1 line and 3 eyes (50%) had the same vision as the baseline.

2- Intravitreal Triamcinolone (IVTA):

As is evident from the table 4, the mean BCVA in decimals increased significantly from baseline to 1st month, then decreased a little in 2nd month and again increased in 3rd and 6th month. The mean BCVA in decimals at 6 months is more than the baseline, thus there was a gain in mean BCVA after 6 months and the gain was statistically significant ($p<0.05$). Also the gain in mean BCVA at 1st, 2nd & 3rd month was statistically significant.As seen in table 5, mean macular thickness decreased significantly from baseline to 1st month remained almost same upto 2nd month and further in 3rd and 6th month. The mean macular thickness at 6 months was less than the baseline. Thus there was decrease in mean macular thickness through 6 months of follow up and this decrease in thickness was statistically significant ($p<0.05$). The decrease in mean macular thickness at 1st, 2nd and 3rd month was also statistically significant ($p<0.05$). As seen in table 6 , for distant vision on Snellen's chart , at the end of 6 months of 7 eyes of 7 patients who had IVTA, 2 eyes (28.57%) improved by more than 2 lines, 4 eyes (57.14%) improved by 1 line and 1 eye (14.28%) had the same vision as the baseline.

3- Intravitreal Bevacizumab :

As is evident from the table 4, the mean BCVA in decimals increased significantly from baseline to 1st month, then decreased a little in 2nd month and remained stable through 3rd and 6thmonth. The mean final BCVA in decimals at 6 months was more than the baseline, thus there was a gain in mean BCVA after 6 months and the gain was statistically significant ($p<0.05$).Also the gain in mean BCVA at 1st,2nd & 3rd month was statistically significant. As seen in table 5, mean macular thickness decreased significantly from baseline to 1st and 2nd month and increased a little in 3rdand 6th month. The mean macular thickness at 6 months was less than the baseline. Thus there was decrease in mean macular thickness through 6 months of follow up and this decrease was statistically significant ($p<0.05$).The decrease in mean macular thickness at 1st, 2nd and 3rd month was also statistically significant. As seen in table 6 , for distant vision on Snellen's chart , at the end of 6 months ,of 8 eyes of 8 patients who had intravitreal Bevacizumab, 3 eyes(37.5%) improved by more than 2 lines, 3 eyes (37.5%) improved by 2 lines, 2 eyes (25%) improved by 1 line.

4- Laser photocoagulation (Macular grid) in BRVO :

As is evident from the table 4, the mean BCVA in decimals increased from baseline to 1st month, then decreased a little in 2nd month and again increased in 3rd and 6th month. The mean final BCVA in decimals at 6 months was more than the baseline, thus there was a gain in mean BCVA after 6 months and the gain was statistically significant ($p<0.05$). The gain in mean BCVA at 1st and 2nd month was not statistically significant, but the gain in mean BCVA at 3rd and 6th month was statistically significant. As seen in table 5, mean macular thickness decreased significantly from baseline through 1st, 2nd, 3rd and 6th month. The mean macular thickness at 6 months was less than the baseline. Thus there was decrease in macular thickness through 6 months of follow up and this decrease was statistically significant ($p<0.05$). As seen in table 6, for distant vision on Snellen's chart , at the end of 6 months, of 10 eyes of 10 patients who had Laser photocoagulation (Macular grid), 4 eyes (40%) improved by 2lines, 3 eyes (30%) improved by 1 line and1 eye (10%) deteriorated by 2 lines.

5- IVTA+ Laser photocoagulation (Macular grid) :

As is evident from the table 4,the mean BCVA in decimals increased from baseline through 1st, 2nd, 3rd & 6th month. The mean BCVA in decimals at 6 months was more than the baseline, thus there was a gain in mean BCVA after 6 months and the gain was statistically significant ($p<0.05$). The gain in mean BCVA at 1st, 2nd, 3rd & 6th month is statistically significant. As seen in table 5, mean macular thickness decreased significantly from baseline through 1st, 2nd, 3rd and 6th month. The mean macular thickness at 6 months was less than the baseline. Thus there was decrease in macular thickness through 6 months of follow up and this decrease was statistically significant ($p<0.05$). As seen in table 6 , for distant vision on Snellen's chart , at the end of 6 months, of 5 eyes of 5 patients who had IVTA + Laser photocoagulation (Macular grid), all 5 eyes (100%) improved by more than 2 lines at the end of 6 months.

6- Bevacizumab + Laser photocoagulation (Macular grid) :

As is evident from the table 4, the mean BCVA in decimals increased from baseline through 1st, 2nd, 3rd & 6th month. The mean BCVA in decimals at 6 months was more than the baseline, thus there was a gain in mean BCVA after 6 months and the gain was statistically significant ($p<0.05$). The gain in mean BCVA at 1st, 2nd, 3rd & 6th month was individually statistically significant. As seen in table 5, mean macular thickness decreased significantly from baseline through 1st, 2nd, 3rd and 6th month. The mean macular thickness at 6 months was less than the baseline. Thus there was decrease in macular thickness through 6 months of follow up and this decrease was statistically significant ($p<0.05$). As seen in table 6, for distant vision on Snellen's chart, at the end of 6 months, of 5 eyes of 5 patients who had Bevacizumab + Laser photocoagulation (Macular grid), 4 eyes (80%) improved by more than 2 lines and 1 eye (20%) improved by 1line at the end of 6 months.

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