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Research Article

A STUDY ON THE CORRELATION BETWEEN SERUM LIPID PROFILE AND DIABETIC MACULAR EDEMA

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A B S T R A C T

Aim: 1. To study the relation between serum lipid profile and diabetic macular oedema.
2. Qualitative and quantitative assessment of macular oedema using OCT and to correlate the foveal thickness with the serum lipid profile and its component.

Materials and Methods: In this cross sectional, observational case control study, a total of 140 patients were divided into 2 equal groups based on their diabetic status and presence of macular oedema. Group 1 included 70 diabetic patients with no macular oedema. Group 2 included 70 diabetic patients with clinically significant macular edema. The lipid profile was tested between the 2 groups and compared. Statistical tests like student's t-test, Fischer's Exact test, & Pearson's correlation test was used to analyse the results.

Results: The means of Total Cholesterol (p=0.0006), LDL (p=0.0461), VLDL (p=0.0349) & Cholesterol: HDL ratio (p=0.0196) levels were found to be higher in the group 2 patients with CSME compared to NON-CSME group 1 patients. The ODD'S RATIO was calculated to know the significance of each lipid components as a risk factor of CSME. Total cholesterol (OR=8.320), LDL(OR=3.536),VLDL(OR=2.204), Cholesterol :HDL ratio(OR=2.711), Triglyceride(OR=1.000), HDL(OR=0.5625). Qualitative assessment of macular edema was done to appreciate sponge like retinal thickenings (55%), as the most common variety followed by cystoid (33.33%)pattern of macular edema. Quantitative assessment of macular edema was done where with increasing foveal thickness there was more worsening of vision.

Pearson's correlation test was calculated to know the correlation coefficient. Total cholesterol(r= -0.06). HDL(r=0.0011) LDL(r= -0.26) VLDL(r=-0.2214), Triglyceride (r=0.013), Cholesterol: HDL(r=-0.098).

Conclusion: The study showed total cholesterol, LDL, VLDL and CHOL:HDL acts as a significant risk factor of diabetes macular edema. Sponge like retinal thickening most common variety of csme on oct. Vision worses with increasing macular thickness.Our study could not show any correlation that rising levels of lipid component is associated with more severe macular oedema.

INTRODUCTION

Diabetic retinopathy (DR) is a major cause of blindness worldwide. According to International diabetes federation 371 million people in the world as of November 2012 live with diabetes and the number is steadily increasing.[1] Diabetic retinopathy and diabetic macular edema are common microvascular complications in the diabetics and may have a sudden and debilitating impact on visual acuity eventually leading to blindness. High serum lipid levels have been proposed as a risk factor for DR. High lipid levels are known to cause endothelial dysfunction due to a reduced bioavailability of nitric oxide and this endothelial dysfunction was suggested to play a role in retinal exudates formation in DR[2]. However large clinical studies showed conflicts about the association of serum lipids with the severity of DR or diabetic macular edema (DME). Therefore, in this study, we aimed to correlate whether serum lipids have an effect on the DME. If the correlation of lipid profile with DR as diabetic macular edema is established the study can lend support to the current treatment guidelines of recommending aggressive lowering of elevated lipids among diabetic patients.

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SUBJECTS AND METHODS

This cross sectional study was conducted in the Regional institute of ophthalmology, Guwahati (Assam) during the period of 1 year from September 2016 to august 2017. Informed consent was obtained from all patients after explaining the purpose of the study design.

The study enrolled 140 patients divided into two groups. The first group consisted of 70 patients of diabetic retinopathy without macular edema in either eye, the second group consisted of 70 patients having clinically significant diabetic macuar edema in atleast one eye.(diagnosed according to ETDRS). DME was defined as thickening of retina within one disc diameter of the centre of macula or the presence of obvious hard exudates in this region.[3]

Methods A detailed ocular and systemic history was taken. Each patients visual acquity both for near and distance, including pin hole and best corrected visual acquity was done with standard snellens chart and near vision chart for both eyes was tested. All patients underwent ocular examination including IOP, AMSLER GRID test, colour vision, slit lamp examination, dilated fundus examination with non contact+ 90D. OCT IMAGING, FFA was done. Lab investigations including hb estimation, fasting Blood glucose, ppbs, serum creatinine, HbA1c, triglyceride (TGL), total cholesterol, high density cholesterol (HDL), low density cholesterol (LDL) and very low density cholesterol (VLDL), CHOLESTEROL and HDL measurements were recorded for all patients.

STATISTICAL METHODOLOGY

The data was presented as mean±standard deviation. Statistical differences during follow ups were assessed using fishers exact test, student- t test. To find correlation between serum lipid profile and DME pearsons correlation of coffiecient was applied and p value less than 0.05 was considered to be statistically significant.

RESULTS

A total of 140 diabetic patients were included in this study.

Age Distribution

In group 1, the age of patients entry ranged from 36 to 83 years. The largest number of patients 26(37.1%) were in the age group of 51-60 years, followed by 15(21.4%)in the age group of 41-50 years, 7(10%)were in age group of 71-80 years and 6(8.6%)in the age group of 31-40 years.There were no patients in <30 years age group and 2(2.8%) were above 80 years.

In group 2, the age of patients entry ranged from 32 to 82 years. The largest number of patients 23(32.9%) were in the age group of 41-50 years, followed by 17(24.3%) in the age group of 51-60 years, 12(17.14%) were in age group of 61-70 years and 10(14.3%) in the age group of 31-40 years. Whereas only 1(1.4%) above 80 years group.

Table 1 shows the age wise distribution of patients between the 2 groups.

	GROUP 1			GROUP 2		
Age distribution	Total	Males	females	Total	males	females
31-40 years	6(8.6%)	4(5.7%)	2(2.9%)	10(14.3%)	7(8.6%)	4(5.7%)
41-50 years	15(21.4%)	10(14.2%)	5(7.2%)	23(32.9%)	13(18.7%)	10(14.2%)
51-60 years	26(37.1%)	17(24.3%)	9(12.8%)	17(24.3%)	12(17.14%)	5(7.16%)
61-70 years	14(20%)	10(14.3%)	4(5.7%)	12(17.14%)	9(12.9%)	3(4.24%)
71-80 years	7(10%)	4(5.7%)	3(4.3%)	6(8.6%)	3(4.3%)	3(4.3%)
>81 years	2(2.8%)	1(1.4%)	1(1.4%)	1(1.4%)	1(1.4%	0(0%)

Analysis of Macular Edema

Out of the 70 patients having CSME in either eye in group 2, 50(71.4%) patients had bilateral CSME, whereas 20(28.6%) patients had unilateral CSME.Thus we had a total of 120 eyes with CSME.

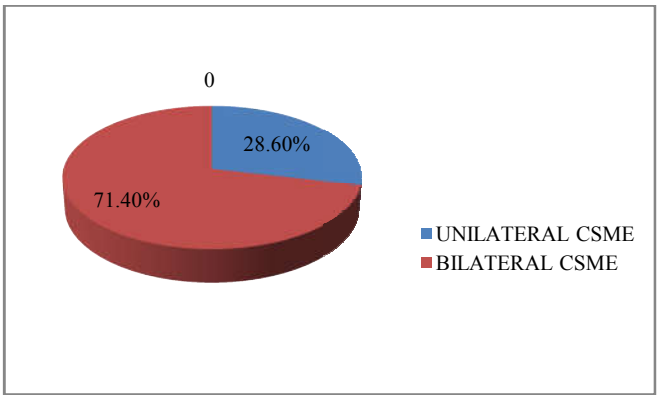

Fig Pie chart showing the bilateral versus unilateral involvement of CSME.

Analysis of Macular Edema

Based on foveal thickness on OCT, we divide 120 eyes having CSME into 3 groups:

Group A: Foveal zone thickness<350µ

Group B: Foveal zone thickness between 350-450µ

Group C: Foveal zone thickness >450µ

Foveal thickness zone	No of eyes	percentage
A	51	42.50%
B	47	39.16%
C	22	18.33%

Visual Status of Patients with Csme

The visual status of the patients with macular edema after best corrected visual acuity is shown in the table:

Foveal thickness	Vision better than 6/18	Vision 6/18 to 6/60	Vision worse than 6/60
Group A <350µ	24	28	0
Group B 350-450µ	15	34	0
Group C >450µ	1	18	3

GROUP C patients have worse best corrected visual acuity. We found that in patients with CSME, the visual acuity worsens with increasing foveal thickness on OCT.

83of the 120 eyes (69.16%) have a visual acuity of 6/18 or worse, implying significant visual impairment among the patients.

Oct Patterns In Csme

Fig Table Showing the Oct Patterns of Csme Patients:

patterns	No of eyes	%percentage
Predominantly spongy	66	55
cystoid	40	33.3
Serous detachment	11	9.1
Vitreomacular traction	3	2.6

Sponge like retinal thickening as the most common variey of macular edema55% followed by cystoids pattern with 33% and vitreomacular traction with lowest pattern 2.6%

Lipid Profile and Csme: Association of Lipid Profile with Csme And Non Csme

Table showing lipid profile in group 2 with CSME

	cholesterol	HDL	LDL	VLDL	Triglyceride	C:HDL
Mean±SD	219.37±54.6	46.44±7.9	145.1±52.2	38.13±18.6	139.21±52.0	4.72±1.2
Median	211.50	45.0	134.50	13.0	126.0	4.6

Table showing lipid profile in group 1 with NO CSME

	cholesterol	HDL	LDL	VLDL	Triglycerides	C:HDL
Mean±SD	193.54±27.8	47.05±12.31	30.729±29.23	30.2±13.8	129.19±55.1	4.27±1.1
Median	191.0	44.5	130.0	30	116.5	4.3

The comparison of the 2 tables show that the mean values of cholesterol, LDL, VLDL, Triglycerides, and cholesterol:HDL was higher in the group 2 patients with CSME.

Cholesterol and Csme

The mean±SD total cholesterol level in the CSME group was 219.37±54.6 while in the NON CSME GROUP it was 193.54±27.8

The standard error of mean in the CSME group was 6.5 whereas standard error of mean in the NON CSME group was 3.3. The p value was found using unpaired t test (p=0.0006) with 138 degrees of freedom. This difference by conventional criteria is considered to be statistically significant.

Table showing total mean cholesterol in CSME and NON CSME Groups

	CSME	NON CSME
No. of Patients	70	70
Mean Total Cholesterol	219.37	193.54
SD	±54.6	±27.8
SEM	6.5	3.3

T TEST, t=3.525, DF:138, CI:95%, P VALUE:0.0006

HDL AND CSME

The mean SD Of the HDL cholesterol in the CSME group was 46.4443±7.921 whereas in the non csme group was 47.057±12.253. the standard error of mean in the CSME group was 0.947 whereas in NON CSME group was 1.465.the p value was found using unpaired t test and it was p=0.7253, with 138 degrees of freedom and 95% CI .By conventional Criteria the value is not significant.

Table Showing Total Mean HDL in Csme and Non Csme Patients

	csme	Non csme
No of patients	70	70
Mean total HDL	46.443	47.057
SD	±7.921	±12.253
SEM	0.947	1.465

Using fishers exact test two sided p value is 0.4264 and was statistically not significant.

LDL Cholesterol and CSME

The mean±SD of the LDL Cholesterol of the group 2 with CSME WAS 145.128±52.243 where as for NON CSME it was 130.729±29.230 .the standard error o mean with the group with CSME was 6.2 whereas with the group with NON CSME was 3.5.The p-value was found using unpaired t test and it was p= 0.0461 with 138 degrees of freedom and 95% confidence interval.

This data by conventional criteria was considered to be statistically significant

Table showing total mean LDL cholesterol in CSME and NON CSME groups

	CSME	NON CSME
NO OF PATIENTS	70	70
MEAN TOTAL LDL	145.128	130.729
SD	±52.243	±29.230
SEM	6.2	3.5

T TEST ,t=2.013 ,DF :138, CI:95%, P VALUE:0.046

Odds ratio was calculated to determine LDL as a risk factor of CSME.the odds ratio was found to be OR =3.536. the 95% confidence intrerval:1.502 to 8.328.using fschers exact test two sided P value is 0.0048and was statistically significant

VLDL and CSME

The mean ± SD of the VLDL group with CSME was found to be 38.128±18.625 whereas in the group with NO CSME was found to be 30.20±13.750. The standard error of mean with group with CSME was found to be 2.226 and in the NON CSME group was 1.643. the p value was calculated using student unpaired t-test with Welch correction and it was found to be 0.0349 with 69 degrees of freedom and 95% CI. This data by conventional criteria was considered to be statistically significant.

	CSME	NO CSME
No of Patients	70	70
Mean Total VLDL	38.128	30.20
SD	±18.625	±13.750
SEM	2.226	1.643

T-TEST t=2.151 DF:69 CI:95% p value=0.0349

Odds ratio was calculated to determine VLDL as a risk factor of CSME and found to be OR=2.204. The 95% CI:1.101 to 4.410 .using fischer"s exact test to sided p value is 0.0374 and was considered statistically significant

Triglycerides and CSME

The mean ±SD total triglycerides level in the CSME group was 139.214±52.060 while in the NON CSME GROUP it was 129.186 ±55.067. The standard error of mean in the CSME group was 6.222 where as standard error of mean in the NON CSME group was 6.583. The p value was found using the unpaired t test (p value 0.2702) with 138 degrees of freedom.
The difference by conventional criteria is considered to be statistically not significant

	CSME	NON CSME
No of patients	70	70
Mean total triglycerides	139.214	129.186
SD	±52.060	±55.076
SEM	6.22	6.583

T TEST, t = 1.107 DF=138 CI=95% P VALUE=0.2702

Odds ratio was calculated to determine triglycerides as a risk factor of CSME and found to be OR=1.000. The 95% CI:0.3529 TO 2.834.Using fischer"s exact test two sided P value is 1.2086 and was considered to be statistically not significant.

Cholesterol:HDL RATIO And CSME

The mean ±SD total CHOL:HDL ratioin the CSME group was 4.718± 1.156 while in the NON CSME group it was 4.262± 1.125.

The standard error of mean in the CSME group was 0.1382 where as standard error of mean in the NON CSME group was 0.1345. The p value was found using the unpaired t test (p value 0.0196) wth 138 degrees of freedom.

The difference was found to be statistically significant.

	CSME	NON CSME
NO OF PATIENTS	70	70
MEAN TOTAL CHOL:HDL	4.718	4.262
SD	±1.156	±1.125
SEM	0.1382	0.1345

T TEST t=2.361 DF=138 CI=95% P VALUE=0.0196

Odds ratio was calculated to determine CHOLESTEROL:HDL as a risk factor for CSME and was found to be OR=2.711. The 95% CI :1.134 TO 6.479. Using fishers exact test two sided P value is 0.0358 and was considered statistically significant.

Correlation of Lipid Profile with Foveal Thickness in Csme Group

We correlated the lipid profile components levels with foveal thicknessoin oct in CSME group. On appyling the pearsons correlation test to the values of lipid profile and foveal thickness, following results were obtained:

Correlation of Cholesterol level and Foveal Thickness on oct

	Cholesterol	Foveal thickness
Mean	219.37	428.714
Standard Deviation	±54.6	±107.6

Pearsons correlation test:
Correlation coefficient(r)=-0.06220
95% CI=-009703 TO 0.4376
P value is 0.6090, considered Not significant

Correlation between LDL and Foveal Thickness

	LDL	Foveal Thickness
MEAN	145.1	428.714
STANDARD DEVIATION	±52.243	±107.6

Pearsons correlation test:
Correlation coefficient(r)=-0.2678
95%CI=-0.2498 TO -0.1718
P value is 0.250, considered not significant

Correlation between Triglyceride and Foveal Thickness

	Triglyceride	Foveal Thickness
MEAN	139.214	428.714
STANDARD DEVIATION	±52.060	±107.6

Pearsons correlation test
Correlation coefficient(r)=0.01301
95%CI=-0.4735to 0.5273
p value=0.9149,considered not significant

Correlation of Colesterol: HDL Ratio and Foveal Thickness of Csme Group

	CHOL:HDL	Foveal thickness
MEAN	4.718	428.714
STANDARD DEVIATION	±1.156	±107.6

Pearsons correlation test
Correlation coefficient(r)=-0.09805
95%CI=-31.540 TO 13.301
p value is 0.4194 ,considered not significant.

DISCUSSION

In our study we tested and compared the total cholesterol between CSME GROUP 2 and NON CSME group 1.

The mean of the total cholesterol was higher in the CSME group 219.37 54.6 versus 193.54 27.8.

The odds ratio was calculated to determine the cholesterol as a risk factor of CSME and value found to be OR=8.320. The 95% CI:2.334 to 29.665. Using fishers exact test two sided P value is 0.0003 and was considered statistically significant.

Miljanovic et al (2004)[4] stated the risk of hard exudates increased more than 2 fold for subjects with total cholesterol. *Al-Bdour et al* (2008)[5] showed a positive relation between diabetic retinopathy and hypercholesterolemia in which it was significantly associated with the development of maculopathy (p=0.04), but not NPDR(P=0.192) OR PDR (P=0.364).

Ucgun et al(2007)[6] demonstrated total cholesterol plays role in exudative macular edema, *R Raman et al*(2010)[7] Stated high serum total cholesterol related to CSME.

The mean of the total LDL in the group1 patient with NO CSME was found to be 130.729 29.2where as in the group 2 with CSME mean of the LDL was 145.128±52.243. Odds ratio was calculated to determine LDL as a risk factor of CSMEE. The ODDS RATIO was found to be 3.536.The 95% confidence interval 1.502 to 8.38. using Fishers exact two sided p value is 0.0048 and was considered statistically significant.

According to report 22,(ETDRS)1996 increased LDL causes increased macular hard exudates. *Miljanovic et al(2004*) DCCT trial found there was two fold increased risk of CSME with rising LDL levels.

In our study we found the mean of triglycerides in the CSME group to be 139.214±52.060 where as non csme group to be 129.186 55.076. but was considered not statistically significant. According to *ETDRS(1996)* study higher triglyceride causes macular hard exudates.Lyons *et al*(2004) (DCCT/EDIC) stated severity of retinopathy was positively associated with triglycerides level. However study by *Ucgun et al (2007*) showed triglycerid have no differences in the outcomes of CSME.1.156 whereas in the NON CSME group it was 4.262

In our study the mean value of cholesterol:HDL ratio in the CSME group was found to be 4.718±1.156 whreas in the NON CSME group it was 4.262±1.125.odds ratio was calculated to determine CHOLESTEROL:HDL as a risk factor CSME and was foundto be OR =2.711. The 95%confidence interval:1.134 to 6.479. using Fisher"s exact test two sided P value is 0.0358 and was considered statistically significant.in a study by mijanovic *et al*(2004) stated 4 fold increased risk of CSME with increased total to HDL CHOLESTEROL ratio.The study by R Raman *et al*(2010) showed high cholesterol ratio related to non csme.

The correlation coefficient of individual lipid components was calculated against foveal thickness of the csme group taking the higher values of foveal thickness on OCT between the eyes for calculation.

Our study failed to establish significant correlation between the lipid components and severity of macular thickness on

OCT. This could be due to inadequate sample size or inadequate adjustment of hidden confounding variables which influences macular thickness.

Ozer et al(2009)[8] conducted a study to evaluate the correlation of lpid profile and clinical presentation of macular edema in diabetes mellitus patients. No correlation was found between serum lipids and macular edema.

In a study by *benarous et al (2011)*[9] no association was found for serum lipids with macular thickness, as assessed by OCT. Serum lipids are independently associated with CSME, but not with DR, mild or mod DME, or macular thickness. These data reflect the different impact of hyperlipidemia in th pathogenesis of DR and DME.

The shortcomings of our study are the present study did not find correlation between seum lipids level and visual acuity. This may be because of the fact that most of the patients included in the study had various types and grades of cataract and correlation for the same could not be done during statistical analysis.

Most of the diabetics in the present sudy had poor glycemic control. Hyperglyemia is associated with dyslipidemia, specifically increased levels of cholesterol and triglycerides, a slight elevation of LDL, but generally little if any change in HDL. Consequently hyperglycemia may be an important confounding factor with respect to both diabetic retinopathy and hypercholesterolemia.

CONCLUSION

This study aimed to determine the relationship between serum lipid profile and the severity of diabetic macular edema.The sudy showed Total cholesterol, LDL, VLDL, AND Cholesterol: HDL ratio is a significant risk factor and is associated with diabetic macular edema.

The severity of macular edema was more with higher grades of retinopathy. In qualitative analysis we studied the macular edema morphology where sponge like retinal thickening was the most common variety followed by cystoids pattern as evaluated by OCT.

Finally we correlated the increasing lipid components with foveal thickness on OCT and could not appreciate any definite pattern of linear relation between lipid components and macular edema severity.

Our study showed statistical significant association of lipid profile with DME. Lipid lowering therapy as treatment and management may prove beneficial in the course and outcome of the macular edema in diabetes patients.

However further studies are warranted to establish the above mentioned fact and statement.

References

1. International Diabetes federation, Diabetes atlas Update .5th edition.November2012.
2. Landmesser U, Hornig B, Drexler H. Endothelial dysfunction in hypercholesterolemia: mechanisms, pathophysiological importance, and therapeutic interventions. *Semin Thromb Hemost*. 2000;26(5):529-537. [PubMed]
3. Focal photocoagulation treatment of diabetic macular edema. Relationship of treatment effect to fluorescein angiographic and other retinal characteristics at baseline: ETDRS Report Number 19. Early Treatment Diabetic Retinopathy Study Research Group. *Arch Ophthalmol*. 1995;113(9):1144-1155.[PubMed]
4. Biljana Miljanovic,Robert J Glynn, David M .nathan,JoAnn E. Manson, Debra A.schaumberg.A Prospective Study of Serum Lipids And Risk of Diabetic Macular Edema In Type 1 DIABETES. *Diabetes* 2004 NOV:53:2883-2902
5. Muawayah D Al-Bdour, Maha I Al till, Khawla M abu samra. Risk factors for diabetic retinopathy among jorda nian Diabetes. *Middle East African Journal of ophthalmology.*
6. Ucgun NI, Yildrim Z, kilic N, Gursel E, the importance of serum lipids in exudative diabetic macular edema in type 2 diabetic patients. *Annals of the new York academy of sciences,biogerontology:mechanisms and intervention,* 2007:1100:213-217
7. Rajiv Raman MS, DNB, Padmaja kumara rani, MS FNB, Vaitheeswaran kulothungan, MSC sudhir reddi rachepalle, ms, MPH, Govindswamy kumaramanickavel, MD, Tarun Sharma. MD, FRCSED, MBA, Influence of serum lipids on clinically significant macular edema vs non clinically significan macular edema.AAO2010:117:766-772
8. Ozer PA, Unlu N, Demir MN, Hazirolan DO, Acar MA, Duman S:Serum lipid profile in DME. *Journal of Diabetes And Its Complications,*2009:2323(4)
9. Rehab benarous, Muhammad B. Sasongko, Salmaan qureshi, Eva Fenwick, Mohamed dirani, tien y. Wong, and Ecosse L. Lamoureux. Differential association of serum lipids with diabetic retinopathy and diabetic macular edema. *Invest Ophthalmolvis sci.*2011:52:7464-7469.

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