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Association of Meibomian Gland Dysfunction with Dyslipidemia

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Abstract: ***Aim****: To determine the association between dyslipidemia and MGD.*
Settings and Design*: it is a prospective, observational study of 1 year duration. Thirty patients who were diagnosed with meibomian gland dysfunction and 30 age and sex matched controls were taken into study after they gave their informed consent and taking into consideration the inclusion and exclusion criteria.*
Methods and Material*: Meibomian gland status was evaluated by, expressibility, and numerical scoring of staining. test was done by taking venous sample of blood in a red-topped vacutainer after overnight fasting. Values of total cholesterol (TC), high-density lipoprotein (HDL) , low-density lipoprotein (LDL), and triglycerides (TGs) were noted.*
Results: *There exists an association between increasing stage of MGD and age and increasing values of TC,LDL,TGs of lipid profile..*

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I. Introduction

Meibomian gland dysfunction (MGD) is defined as a chronic, diffuse abnormality of the meibomian glands, commonly characterized by terminal duct obstruction and/or qualitative/quantitative changes in the glandular secretion. This may result in alteration of the tear film, symptoms of eye irritation, clinically apparent inflammation, and ocular surface disease.(1) Meibomian glands contribute to the lipid component of the tear film, and their normal secretion prevents premature evaporation of tears from the ocular surface.(2) Their secretions consist of a complex mixture of various polar and nonpolar lipids containing cholesterol and wax esters, diesters, triacylglycrides, free cholesterol, free fatty acids, and phospholipids.(3) With a number of changes in lifestyle involving dietary preferences, work habits and the advent of computer usage in all spheres of life, the incidence and prevalence of dry eye has increased dramatically in the general population. MGD may well be the leading cause of dry eye disease throughout the world(1) but is often overlooked in busy out-patient settings .

II. Material And Methods

Study Design: The study is a prospective observation case-control study.
Study location: this a a tertiary care teaching hospital based study done in department of Ophthalmology, AVBRH, Sawangi, Wardha, Maharashtra.
Study duration: Study was done over a period of 1 year from September 2018-semtember 2019.
Sample size : 30 patients as cases and 30 as controls.
Subjects and selection methods: 30 sequentially collected patients diagnosed with MGD together with 30 age and sex matched controls were enrolled.
a. Meibum quality was assessed in each of eight glands of central third of the lower eyelid on a 0–3 scale for each gland:
0 = clear meibum
1 = cloudy meibum
2 = cloudy with debris
3 = thick like toothpaste (range 0–24)

b. Expressibility of meibum:assessed from 5 glands of central third of the lower eyelid on a scale of 1to3.
1 = 3–4 glands expressible
2 = 1–2 glands expressible
3 = no glands expressible

c. Numerical staining: Scores refer to a summed score of staining of the exposed cornea and conjunctiva. Fluorescein stains were used. The Oxford scale has a range of 0–15.

Stages of MGD: (1)

STAGE	MGD GRADE	SYMPTOMS	CORNEAL STAINING
1	+ (minimally altered expressibility and secretion quality)	None	None
2	(mildly altered expressibility and secretion quality)	Minimal to mild	None to limited
3	+++ (moderately altered expressibility and secretion quality)	Moderate	Mild to moderate: mainly peripheral
4	++++ (severely altered expressibility and secretion quality)	Marked	Marked; central in addition

Inclusion criteria:
1. Patients who were 18 year and above
2. Those who gave valid consent

Exclusion criteria:
1. Patients below 18 years.
2. Patients not giving valid consent.
3. Recent ocular surgery
4. Treatment with topical steroid 4 weeks before study.
5. Changes in the drainage system of lacrimal apparatus
6. Ongoing glaucoma medications
7. Patients suffering from keratoconjuctivits of infectious type
8. Patients who are on OCP
9. Patients on antihypertensive medication
10. Pregnant women
11. Patient with rosacea, sjogren's syndrome, cholestatic liver disease and parkinsonism.

Procedure methodology

Assessment of the patient was done with the help of: A) Complete ophthalmic examination which include assessment of lacrimal system for any abnormality B) Assessment of meibomian gland which was done by putting pressure at middle one third of both upper and lower eyelid while observing under the slit lamp. Diagnosis of MGD was done by criteria based on the international workshop of MGD:(4) Lipid profile: test was done by taking venous sample of blood in a plain vial after overnight fasting and was done using VITROS 5600 by Ortho clinical Diagnostics. Parameters taken into account were : (5)
Triglycerides (TG): Hypertriglyceridemia >150 mg/Dl
Total cholesterol (TC): Hypercholesterolemia >200 mg/dL
Low-density lipoprotein (LDL) cholesterol (LDL-C): High LDL >130 mg/dL
High-density lipoprotein (HDL) cholesterol (HDL-C): High HDL >40 mg/dL.

Statistical analysis used:

Patients diagnosed with dislipidemia and MGD were entered in MS Excel spreadsheet and Statistical Package for the SocialSciences (SPSS) version 24.0 was used to analysis the data. The correlation between age and stage was assessed by Spearman's correlation coefficient. A P value of <0.05 was considered statistically significant.

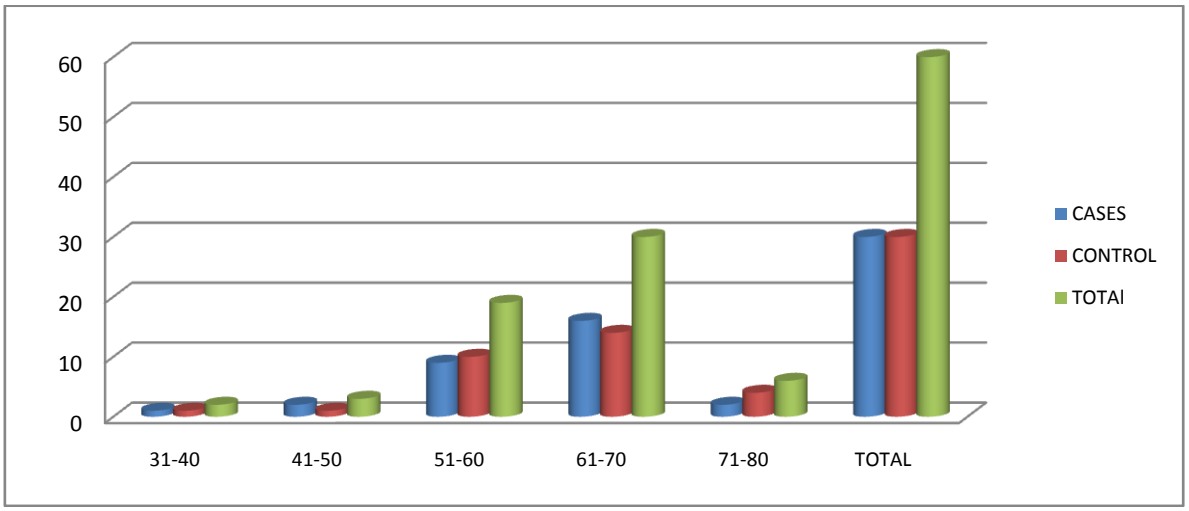
III. Result

A total of 30 cases and 30 controls were taken into the study. Both of these were age and sex matched.The number of patients in age group of 31-40 were 3.33% , in 41-50 were 5% , 51-60 were 31.67% , 61-70 were 50 % and 71-80 were 10 %. Maximum number of patients were in age group of 61-70 and least were in age group of 31-40 year .(Table 1 , graph1)

Table 1: Age Wise Distribution Of Cases And Controls

	CASES	CONROL	TOTAL	PERCENTAGE
31-40	1	1	2	3.33%
41-50	2	1	3	5%
51-60	9	10	19	31.67%
61-70	16	14	30	50%
71-80	2	4	6	10%
TOTAL	30	30	60	100%

GRAPH 1: AGE WISE DISTRIBUTION OF CASES AND CONTROLS

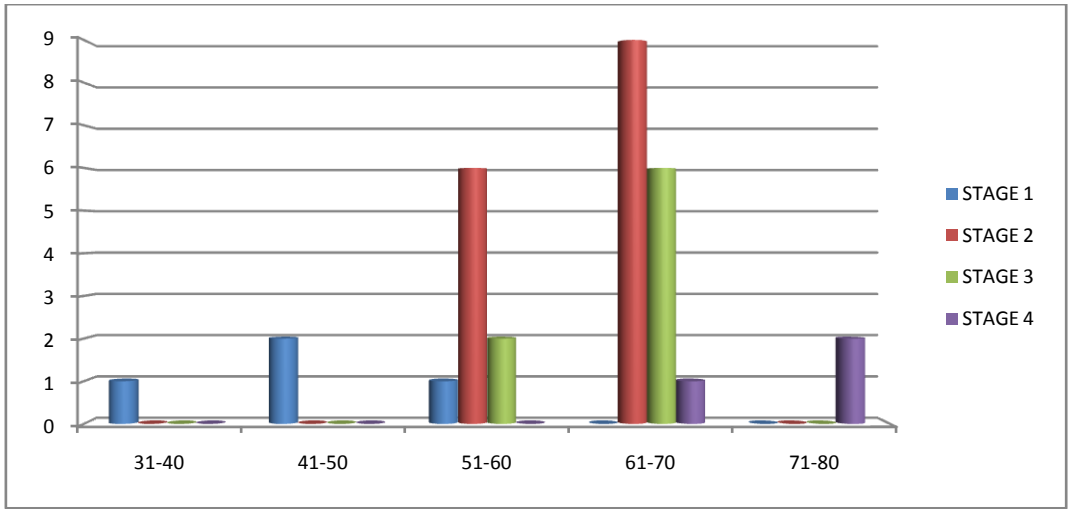


On calculating the number of patients in each stage, maximum number of cases were in stage 2 (50 %) and most of them (30%) were in age group of 61-70. Age group of 51-60 had 20 % of these patients. The number of patients in stage 3 were 26.6 % of all cases with maximum number in age group of 61-70 (20 %). Least number of patients were in stage 4 (10%). Stage 1 had 13.33 % of the cases and all of these were under the age group of 31-50 years. (Table 2 , graph 2)

TABLE 2 : AGE DISTRIBUTION OF CASES AND STAGES OF MGD

	STAGE 1	STAGE 2	STAGE 3	STAGE 4	Total
31-40	1	0	0	0	1
41-50	2	0	0	0	2
51-60	1	6	2	0	9
61-70	0	9	6	1	16
71-80	0	0	0	2	2
TOTAL	4(13.33%)	15(50%)	8(26.66%)	3(10%)	30

GRAPH 2 : AGE DISTRIBUTIOJN OF CASES AND STAGES OF MGD

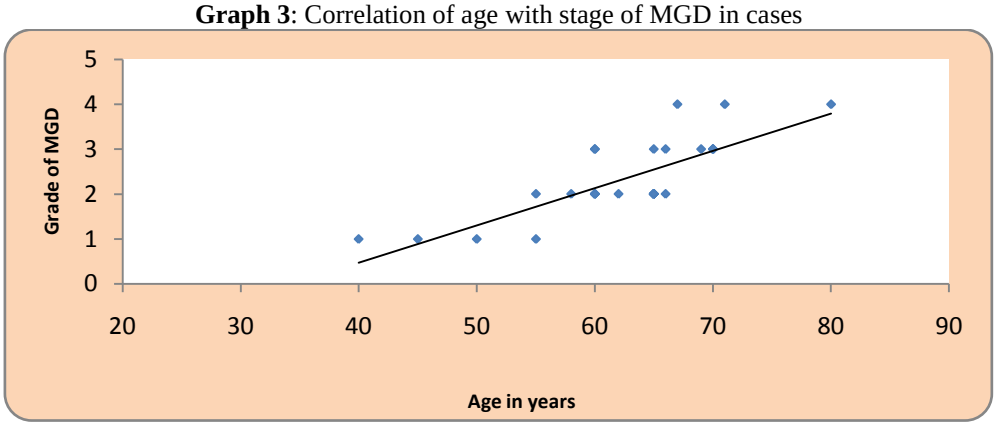


The number of patients in higher stages of MGD was more as the age group increase. This shows a positive co-relation with increasing age and stages of MGD. (Table 3 graph 3). Standerd deviation of Age is 7.92 and that of grades of MGD is 0.84

Table 3: Correlation of age with stage of MGD in cases; Spearman's Rank order correlation

	Mean	SD	ρ(Rho)
Age(yrs)	62.46	7.92	0.772
Grade of MGD	2.33	0.84	p=0.0001,S

Graph 3: Correlation of age with stage of MGD in cases



Stage 1 shared equal number of males and females .out of the 30 cases enrolled, 15 were males and rest were females. The maximum number of cases was in stage 2 which had 23.33% of cases as males and 26.60 % of females. In stages 3, sex ratio was 10 % and 16 % as females. No female was found to have stage 4 of MGD.(Table 4)

Table 4 : Sex wise distribution and stages of MGD

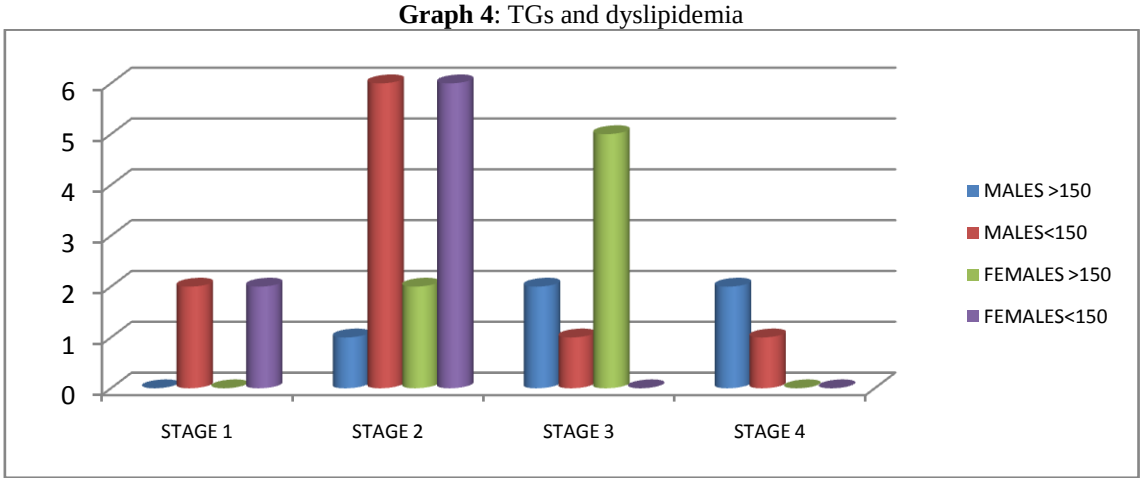
	MALES	FEMALES	Total	χ2-value
STAGE 1	2(6.66%)	2(6.66%)	4	3.56 p=0.31,NS
STAGE 2	7(23.33%)	8(26.66%)	15	
STAGE 3	3(10%)	5(16%)	8	
STAGE 4	3(100%)	0(%)	3	
Total	15(%)	15(%)	30	

The number of MGD patients with TGs of < 150 mg/dl was 19(60%). While >150 was 12 (40 %). Maximum number of patients with TGs < 150 belong to stage 2 i.e. 6 (20%) whereas least number of patients were in stage 4 i.e. 1(3.33).(Table 5 , graph 4)

Table 5: TGs and dyslipidemia

		STAGE 1		STAGE 2		STAGE 3		STAGE 4		TOTAL
		M	F	M	F	M	F	M	F	-
TG	<150	2(6.66%)	2(6.66%)	6(20%)	6(20%)	1(3.33%)	0(0%)	1(3.33%)	0(0%)	18(60%)
	>150	0(0%)	0(0%)	1(3.33%)	2(6.66%)	2(6.66%)	5(1666%)	2(6.66%)	0(0%)	12(40%)
χ2-value		14.62,p-value=0.0234,Significant								

Graph 4: TGs and dyslipidemia

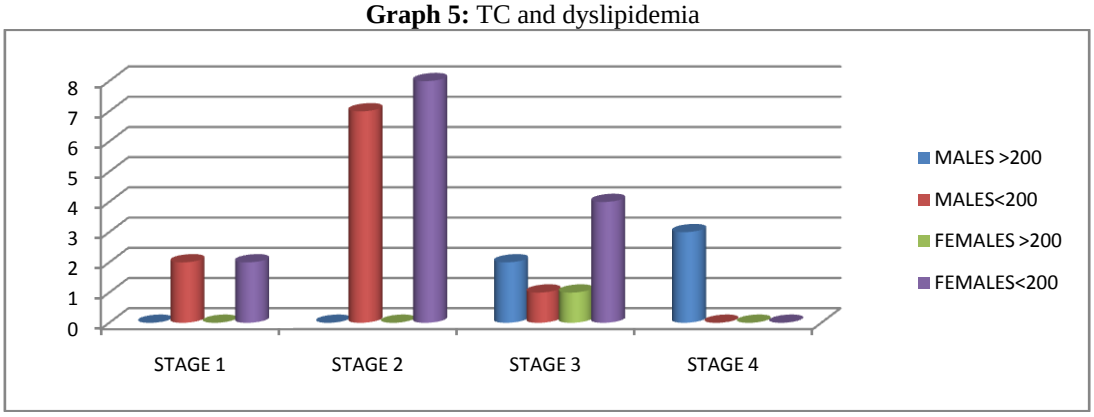


Number of patients with TC<200 was 24(80 %) while 6(20 %)had values above 200.Maximum number of patients with <200 TC were in stage 2 i.e. 7 (23.33%) while minimum were in stage 1 i.e. 4(13.32%). No such patients were present in stage 4.Maximum number of patients with > 200 TC were in stage 4 i.e. 3(10%) wereas none were present in stage1 and 2. (Table 6, graph 5)

Table 6: TC and dyslipidemia

		STAGE 1		**STAGE 2**		**STAGE 3**		**STAGE 4**		**TOTAL**
		M	F	M	F	M	F	M	F	-
TC	<200	2(6.66%)	2(6.66%)	7(23.33%)	8(26.66%)	1 (3.33%)	4(13.33%)	0(0%)	0(0%)	24(80%)
	>200	0(0%)	0(0%)	0(0%)	0(0%)	2 (6.66%)	1(3.33%)	3(10%)	0(0%)	6(20%)
χ2-value		20.83,p-value=0.002, Significant								

Graph 5: TC and dyslipidemia

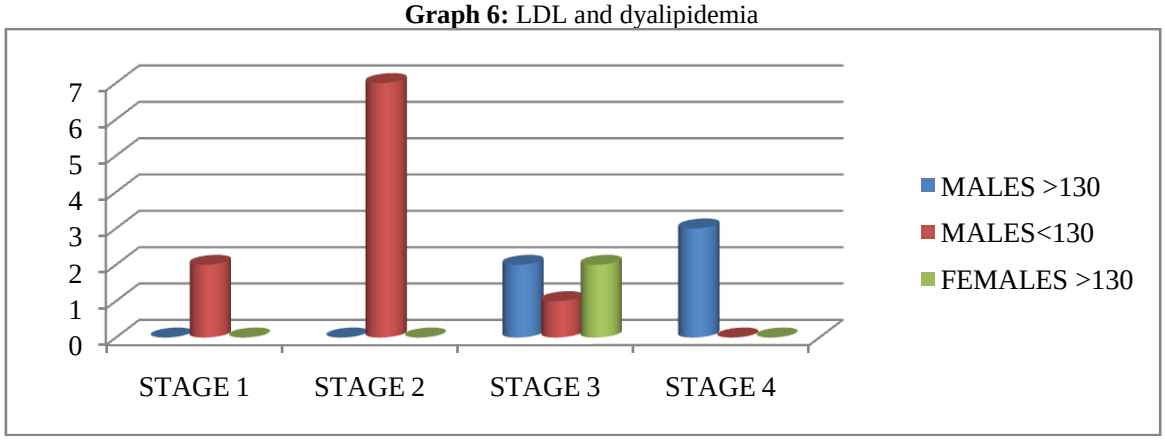


The total number of patients with LDL >130 are 7(23.33%) while those with LDL<130 were 23 (765.66%). Maximum number of patients with LDL >130 were in stage 4(10 %) while no patients were seen in stage 1 and 2.With LDL <130, maximum were in stage 2(50 %) while stage 4 has no such patients. (Table 7 , graph 6)

Table 7: LDL and dyslipidemia

		STAGE 1		STAGE 2		STAGE 3		STAGE 4		TOTAL
		M	F	M	F	M	F	M	F	-
LDL	<130	2(6.66%)	2(6.66%)	7(23.33%)	8(26.66%)	1(3.33%)	3(10%)	0(0%)	0(0%)	23(76.66%)
	>130	0(0%)	0(0%)	0(0%)	0(0%)	2(6.66%)	2(6.66%)	3(10%)	0(0%)	7(23.33%)
χ2-value		19.57,p=0.0033,Significant								

Graph 6: LDL and dyalipidemia

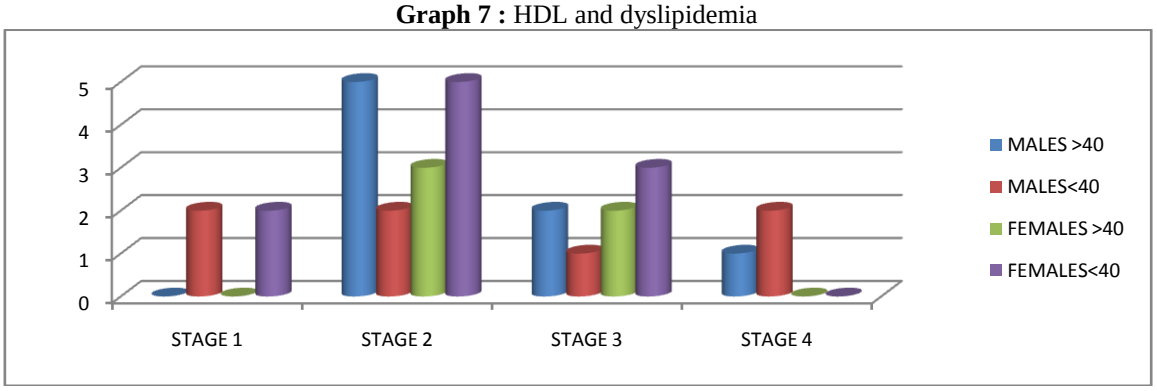


The total number of patients with HDL >40 is 13(43.33%) and <40 were 17(56.66%). Maximum number of patients with HDL >40 were in stage 2(26.66) while no patients were present in stage 1.Minimum number of patients with HDL <40 were in stage 2 (23.33%) while minimum were in stage 4 (6.66%) (Table 8 , graph 7)

Table 8: HDL and dyslipidemia

		STAGE 1		STAGE 2		STAGE 3		STAGE 4		TOTAL
		M	F	M	F	M	F	M	F	-
HDL	<40	2(6.66%)	2(6.66%)	2(6.66%)	5(16.66%)	1(3.33%)	3(10%)	2(6.66%)	0(0%)	17(56.66%)
	>40	0(0%)	0(0%)	5(16.66%)	3(10%)	2(6.66%)	2(6.66%)	1(3.33%)	0(0%)	13(43.33%)
χ2-value		6.23,p-value=0.39,Not Significant								

Graph 7 : HDL and dyslipidemia



In controls, patients having TC level <200 were 70 % while with >200 were 30%. Level of HDL with level <40 were 53.34% and in > 40 it was 46.66%. In LDL, levels less than 130 were seen in 90 % of the controls while it was more than 130 only in 10% of the controls. Similarly, level of triglyceride was < 150 in 80 % of control while it was >150 in 20%.

IV. Discussion

The result of this study shows that there is a positive correlation between age and stages of MGD. The statistics calculation by spearman's rank order correlation shows a positive correlation and a rho valve of 0.772 and p value of 0.0001 as significant.

Along with this there is a significant correlation with increase level of TC. The number of MGD patients with TC <200 mg/dl and >200 mg/dL in our study were 24(80%) and 6 (20%), respectively. Maximum number of patients with TC <200 mg/dL belonged to stage 2, while minimum number of patients with TC >200 mg/dL belonged to stage 4. As the P value is <0.002, it indicates a strong association between hypercholesterolemia (levels >200 mg/dL) and increasing severity of stage of MGD.

The number of MGD patients with TGs <150 mg/dL and>150 mg/dL in our study were 18(60%) and 12 (40%),respectively. Maximum number of patients with TGs <150 mg/dL belonged to stage 2, while maximum number of patients with TC >200 mg/dL belonged to stage 3. As the P value is <0.0234, it indicates a strong association between hypercholesterolemia (levels >200 mg/dL) and increasing severity of stage of MGD and LDL level. The number of MGD patients with LDL <130 mg/dL and >130 mg/dL in our study were 23(76.66%) and 7 (23.33%), respectively. Maximum number of patients with TC <130 mg/dL belonged to stage 2, while maximum number of patients with TC >200 mg/dL belonged to stage 3. As the P value is <0.0033, it indicates a strong association between hypercholesterolemia (levels >200 mg/dL) and increasing severity of stage of MGD.

The number of MGD patients with HDL <40 mg/dL and >40 mg/dL in our study were 17(56.66%) and 13 (43.33%), respectively. Maximum number of patients with HDL <40 mg/dL belonged to stage 2, while maximum number of patients with HDL >40 mg/dL ALSO belonged to stage 2. As the P value is = 0.39, it does not establish a correlation between the two and was found to be insignificant and so was the relation of MGD with either of the sexes.

In study by ***gulani et. al*** (5). also found correlation of increasing age and higher stages of MGD.

Study done by ***Dao et al*** (6) also could not detect any significant correlation between MGD and elevated or low level of HDL. His study also establish a prevalence of dyslipidemia in MGD patients .It mainly co related to cholesterol and TGs .However they could not establish correlation between level of LDL and MGD. This can be explained due to large difference in sample size of the two study.

Study by ***bhkhari et. al*** (7) concludes that disease severity of MGD is more with higher level of TGs and LDL a positive correlation was found for female sex .This discrepancy can be explained by 2 facts: Large difference in number of patients involved and less number of females in higher age group.Studies with larger populations are needed to prove whether this association is indeed causal. Treatment aimed at correcting hyperlipidemia may also improve the clinical features of MGD.(2)

V. Conclusions

Higher stages of MGD are associated with increased age. MGD and increasing levels of LDL, total cholesterol, and triglycerides have a positive correlation. A patient with MGD must be investigated for dyslipedemia and treated accordingly.

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