



**ORIGINAL RESEARCH PAPER**

**General Medicine**

**“A STUDY ON PATTERN OF SERUM LIPID LEVELS IN PATIENTS WITH TYPE 2 DIABETES MELLITUS AND PERIPHERAL ARTERY DISEASE.”**

**KEY WORDS:** Peripheral arterial disease, dyslipidemia, type 2 diabetes mellitus.

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**ABSTRACT**

**Background :** Type 2 diabetes mellitus is associated with elevated triglycerides, total cholesterol, LDL and decreased HDL levels. However the studies on association of lipid levels in diabetics with Peripheral arterial disease (PAD) show variable results.

This descriptive study will study the pattern of dyslipidemia in type 2 diabetes and diabetics with PAD.

**Objectives:** To study the relation between serum total cholesterol, LDL cholesterol, HDL cholesterol, triglycerides levels and PAD in type 2 diabetics.

**Materials and methods:** A descriptive study was carried out over a period of 18 months. 100 diabetic patients were included in the study. Patient selection was based on inclusion and exclusion criteria.

**Results:** In this study it was found that 23% of the diabetics had an ABI less than 0.9 suggestive of PAD. It was observed that 84% of the diabetics had dyslipidemia with a pattern of low HDL (62%) and high triglyceride levels (61%).

High levels of total cholesterol, LDL and serum triglycerides with low levels of HDL were found in diabetic patients with PAD.

**Conclusion:** Diabetics with peripheral arterial disease have greater degree of dyslipidemia and different pattern of dyslipidemia than those diabetics without PAD.

**INTRODUCTION**

Diabetes in all its forms inflicts unacceptably high human, social and financial costs on countries at all income levels. As the years go by incidence of diabetes mellitus especially type 2 diabetes is on the rise.

Diabetes mellitus has many microvascular and macrovascular complications. PAD is a common macrovascular complication seen in diabetes which leads to significant morbidity.

Patients with type 2 diabetes mellitus have a unique dyslipidemia characterized by hypertriglyceridemia, smaller, denser low-density lipoprotein (LDL) cholesterol and low levels of high density lipoprotein (HDL) cholesterol. 1

Dyslipidemia is one of the major contributors to accelerated atherosclerosis in diabetic individuals and increases the risk for cardiovascular events.

**METHODS**

**SOURCE OF DATA:**

The study included inpatients of a medical college hospital with type 2 diabetes mellitus

**METHOD OF COLLECTION OF DATA:**

**Study design:**

Descriptive study.

**Sample Size:**

A Sample size of 100 was selected for the study using purposive sampling technique based on inclusion and exclusion criteria.

**Methods:**

Patients fulfilling the eligibility criteria were selected for the study.

A detailed history was obtained from each patient regarding comorbidities and history of diabetes mellitus. Blood samples were collected for Fasting Lipid Profile.

The optimum Lipid values were taken as follows based on NCEP ATP III Guidelines- Total Cholesterol <200 mg/dl, LDL Cholesterol <100 mg/dl, Triglycerides <150 mg/dl and HDL

Cholesterol < 40 mg/dl.2

Individual ABI was obtained for each leg by dividing corresponding ankle pressure by the brachial pressure. An ABI of < 0.9 was indicative of peripheral arterial disease.3

**Inclusion Criteria**

- Patients with type 2 diabetes mellitus with a period of 5 to 20 years since diagnosis.

**Exclusion Criteria**

- Filariasis of the lower limb or lower limb swelling due to other causes which could interfere with measurement of ABI.
- Smokers.
- Known cases of peripheral vascular disease due to causes like coagulopathies and hyperhomocysteinemia.
- Trauma or surgery involving lower limb.
- Patients receiving lipid lowering agents.

**Data Analysis**

Data collected was analyzed by frequency, percentage and mean.

**RESULTS**

This study was conducted on 100 diabetic inpatients of a medical college hospital in mangalore. The data collected was analysed and following results were obtained.

**1. ABI IN THE STUDY POPULATION**

**FIGURE 1: ABI IN CASES**

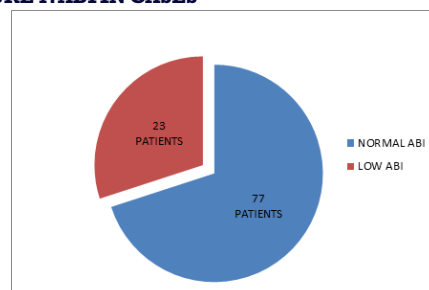


Figure 1 depicts that 77% of the cases had a normal ABI (ABI > 0.9) and 23% of the cases had a low ABI (ABI < 0.9).

**2. DYSLIPIDEMIA IN DIABETES**

**TABLE 1: DYSLIPIDEMIA IN DIABETES**

DYSLIPIDEMIA	NO OF PATIENTS	PERCENT
YES	84	84
NO	16	16
TOTAL	100	100

In this study it was observed that dyslipidemia was present in 84% of the diabetics and there was no lipid abnormality seen in 16% of the diabetics.

**3. PATTERN OF DYSLIPIDEMIA IN DIABETES**

**FIGURE 2: PATTERN OF DYSLIPIDEMIA IN DIABETES**

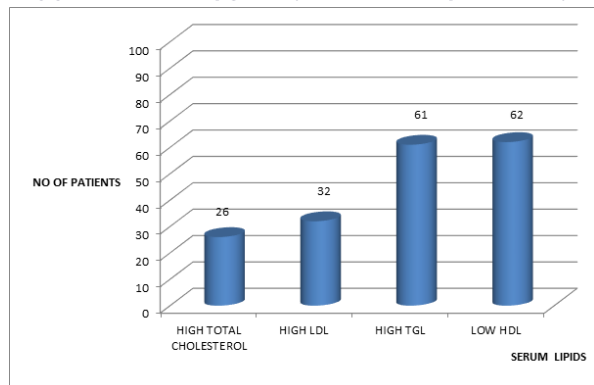


Figure 2 demonstrates that the most common lipid abnormality in this study was low HDL levels seen in 62% of the diabetics.

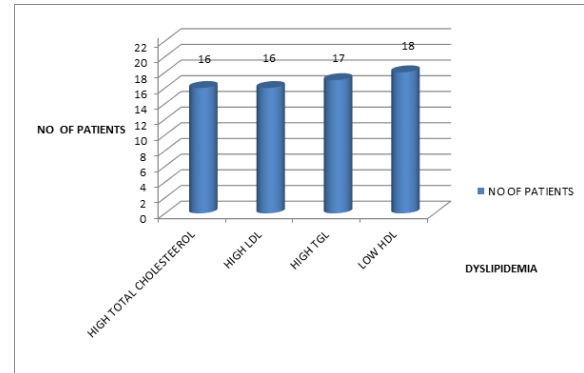
Hypertriglyceridemia was seen in 61% of the cases. High serum LDL and serum total cholesterol levels were seen in 32% and 26% of the cases respectively.

**4. PATTERN OF DYSLIPIDEMIA IN CASES WITH ABI < 0.9**

**TABLE 2: PATTERN OF DYSLIPIDEMIA IN CASES WITH ABI < 0.9**

LIPID LEVELS(mg/dl)	NO. OF CASES	PERCENTAGE %
HDL < 40	18	78.26
LDL > 100	16	69.56
TOTAL CHOLESTROL > 200	16	69.56
TRIGLYCERIDE > 150	17	73.91

**FIGURE 3: DYSLIPIDEMIA IN CASES WITH ABI < 0.9**



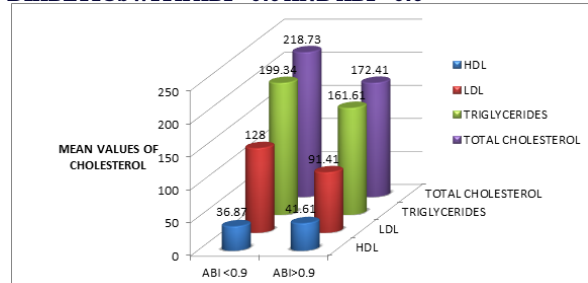
High serum total cholesterol and high LDL levels were seen in 69 % of the cases. Hypertriglyceridemia and low HDL levels were seen in 73.91% and 78.29% of the cases with ABI < 0.9.

**5. COMPARISON OF LIPID LEVELS IN DIABETICS WITH PAD AND WITHOUT PAD**

**TABLE 3: DISTRIBUTION OF MEAN LIPID LEVELS IN DIABETICS WITH ABI < 0.9 AND ABI > 0.9**

ABI	NO. OF PATIENTS	MEAN (mg/dl)
HDL < 0.9	23	36.87
> 0.9	77	41.61
LDL < 0.9	23	128.0
> 0.9	77	91.41
TRIGLYCERIDES < 0.9	23	199.34
> 0.9	77	161.61
TOTAL CHOLESTEROL < 0.9	23	218.73
> 0.9	77	172.41

**FIGURE 4: DISTRIBUTION OF MEAN LIPID LEVELS IN DIABETICS WITH ABI < 0.9 AND ABI > 0.9**



The above graph shows the distribution of serum lipid levels among diabetic patients with ABI < 0.9 and ABI > 0.9.

The mean total cholesterol level in diabetics with PAD was found to be 218.73mg/dl in comparison to 172.41mg/dl in diabetics without PAD.

The mean LDL was found to be 128 mg/dl in diabetics with PAD in comparison to the 91.41mg/dl in diabetics without PAD.

The degree of dyslipidemia was greater in diabetic patients with peripheral arterial disease than in diabetics without peripheral arterial disease.

**DISCUSSION**

**AGE DISTRIBUTION-**

The present study demonstrated that most of the patients were between 51-60 years of age with a mean age of 59.80 years.

In a study done in Delhi by Agarwal A K et al to assess the prevalence of peripheral arterial disease in type 2 diabetics, the mean age was found to be 59.4 years.3

This may reflect that there are more diagnosed cases of diabetes in the older age group.

**SEX DISTRIBUTION-**

In the present study diabetics were predominantly males comprising of 62% of cases and females constituted 38% of the cases.

As depicted in Table 4, in a study done on type 2 diabetic patients in Zagreb, the men constituted 54.6% of the cases and women 45.4%. The study done in Delhi had 54% males and 46% females.3

**TABLE 4: COMPARISON OF SEX DISTRIBUTION OF CASES INVARIOUS STUDIES.**

	Agarwal et al3	Zagreb study4	Present study
Males	54%	54.6%	62%
Females	46%	45.4%	38%

**PERIPHERAL ARTERIAL DISEASE IN DIABETICS.**

In the present study there were 23 diabetic patients with ABI less than 0.9 suggestive of peripheral arterial disease (23%).

In a similar study conducted in New Delhi on 146 diabetic patients, it was found that 21 cases (14.4%) were detected to have peripheral arterial disease based on ABI studies.<sup>3</sup>

**LIPID PROFILE OF DIABETIC SUBJECTS**  
**TABLE 5- COMPARISON OF LIPID PROFILE IN DIABETIC SUBJECTS INVARIOUS STUDIES**

LIPIDS(mg/dl) mean	UKPDS27 <sup>5</sup>		Agarwal et al <sup>7</sup>	Present study
	Males	Females		
Total cholesterol	212	224	181	183.07
HDL	39	42.15	45	40.52
LDL	139	150	112	99.83
Triglycerides	159	159	127	170.29

Table 5 gives a comparison of lipid profiles of diabetic patients in different studies. The mean total cholesterol level was at a higher level with a mean of 220 mg/dl in the UKPDS5 study in comparison to 183 mg/dl and 181 mg/dl in our study and Delhi study 3 respectively.

The mean HDL cholesterol was 40.52 mg/dl. The variation in lipid levels maybe due to the differences in lifestyle habits of the 3 different population samples.

**DYSLIPIDEMIA IN DIABETICS**  
**TABLE 6 – DYSLIPIDEMIA IN DIABETES**

	Agarwal RP et al (%) <sup>6</sup>	This study(%)
<b>HIGH TOTAL CHOLESTEROL</b>	44.94	26
<b>LOW HDL</b>	47.72	62
<b>HIGH LDL</b>	45.26	32
<b>HIGH TRIGLYCERIDES</b>	42.41	61

The HDL cholesterol and Serum Triglycerides in the present study was found to be 62% and 61% respectively in comparison to 47.72% and 42.41 % in the study done in Bikaner<sup>6</sup>. This shows that HDL and serum triglycerides were affected to a greater extent in my study than in the study done in Bikaner.

**PERIPHERAL ARTERIAL DISEASE AND DIABETICS**  
**TABLE 7 : COMPARISON OF CASES OF PAD BASED ON ABI ANALYSIS IN TYPE 2 DIABETICS**

STUDY	PREVALENCE %
Agarwal et al <sup>3</sup>	14.4
Marinelli et al <sup>7</sup>	33
<b>This study</b>	<b>23</b>

Table 7 indicates that the present study showed that 23 % of the diabetic had PAD diagnosed by ABI studies in comparison to study done by Agarwal et al<sup>3</sup> where the incidence was 14.4%.

**COMPARISON OF LIPID LEVELS IN DIABETICS WITH PERIPHERAL ARTERIAL DISEASE**

**TABLE 8: MEAN LIPID LEVELS IN DIABETICS WITH PAD**

LIPIDS(mg/dl) mean	Agarwal et al <sup>3</sup>	This study
Total cholesterol	180	218.73
HDL	43	36.87
LDL	116	128.0
Triglycerides	125	199.34

The degree of dyslipidemia in diabetics with PAD in the present study was greater than that found in a similar study done in Delhi.

The mean Total cholesterol, LDL cholesterol and Serum

triglycerides were greater in the present study than the mean lipid levels in the Delhi study.

The mean HDL cholesterol in this study was lower than that obtained in the other study.

**CONCLUSION**

Diabetics with peripheral arterial disease have greater degree of dyslipidemia than those without peripheral arterial disease; Dyslipidemia in diabetes is an important contributing factor to the development of peripheral arterial disease. Hence the prompt control of dyslipidemia in diabetics may aid in reducing the incidence of peripheral arterial disease. Further studies are needed to evaluate and confirm the possibility of a better outcome with aggressive management of dyslipidemia in diabetics with PAD.

**DECLARATION**

**Funding: None**  
**Conflict of Interest: None**  
**Ethical Clearance: Obtained**

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