



A Comparative Study of Dyslipidemia in Newly Diagnosed Type 2 Diabetes Mellitus Patients with and Without Hypertension

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KEYWORDS

Type 2 Diabetes Mellitus, Hypertension, Dyslipidemia, Glycemic Control, Cardiovascular Risk

ABSTRACT:

Background: Dyslipidemia is a common metabolic disorder in Type 2 Diabetes Mellitus (T2DM) and may be further aggravated by coexisting hypertension, increasing cardiovascular risk. This study aims to compare the lipid profiles and glycemic status of newly diagnosed T2DM patients with and without hypertension.

Methods: A cross-sectional observational study was conducted in the Department of General Medicine in collaboration with the Department of Biochemistry at IIMSR, Lucknow. A total of 140 newly diagnosed T2DM patients aged 30–65 years were enrolled and divided into two groups based on the presence or absence of hypertension. Data on demographic, anthropometric, clinical, and biochemical parameters were collected and analyzed using SPSS v26.0.

Results: T2DM patients with hypertension had significantly higher fasting (224.57 ± 92.87 mg/dL) and postprandial (266.97 ± 88.90 mg/dL) blood glucose levels compared to those without hypertension. Total cholesterol, triglycerides, LDL, and VLDL were also significantly elevated in the hypertensive group ($p < 0.05$). No significant differences were observed in HDL levels or cholesterol/HDL ratios.

Conclusion: Newly diagnosed T2DM patients with hypertension exhibit significantly worse dyslipidemia and glycemic control compared to non-hypertensive counterparts. Early intervention targeting lipid and blood pressure control is crucial in preventing cardiovascular complications in this population.



INTRODUCTION

Type 2 diabetes mellitus (T2DM) is a chronic metabolic disorder characterized by insulin resistance, relative insulin deficiency, and hyperglycemia. Its increasing prevalence globally, especially in low- and middle-income countries, poses a serious public health concern. According to the International Diabetes Federation (IDF), approximately 537 million adults were living with diabetes in 2021, and this number is projected to rise to 643 million by 2030 [1]. In India, the burden of diabetes is rapidly escalating, earning the country the moniker of the "diabetes capital of the world" [2].

Dyslipidemia is a common comorbidity associated with T2DM, and it significantly contributes to the development of macrovascular complications such as coronary artery disease, stroke, and peripheral vascular disease [3]. Diabetic dyslipidemia typically presents as a triad of elevated triglycerides, decreased high-density lipoprotein cholesterol (HDL-C), and elevated low-density lipoprotein cholesterol (LDL-C) particles, especially small dense LDL [4].

Hypertension frequently coexists with T2DM and acts synergistically to increase the risk of cardiovascular morbidity and mortality [5]. It has been postulated that the coexistence of hypertension and diabetes further exacerbates the atherogenic dyslipidemic profile, worsening the metabolic milieu [6]. Several mechanisms, including insulin resistance, endothelial dysfunction, increased sympathetic activity, and chronic inflammation, have been implicated in this metabolic clustering [7].

Early identification and comparative analysis of dyslipidemia in newly diagnosed diabetic patients with and without hypertension are critical to tailoring preventive strategies and treatment interventions aimed at reducing cardiovascular risk.

This study was therefore undertaken to assess and compare the patterns and severity of dyslipidemia, glycemic control, and other metabolic parameters in newly diagnosed T2DM patients with and without hypertension, aiming to understand the interrelationship between hypertension and dyslipidemia in the diabetic population.

MATERIALS AND METHODS

Place of Study

This study was conducted in the Department of General Medicine in collaboration with the Department of Biochemistry at Integral Institute of Medical Sciences and Research (IIMSR), Lucknow.

Study Design and Duration

This was a cross-sectional observational study that included patients with newly diagnosed Type 2 Diabetes Mellitus (T2DM) with and without hypertension. The data collection was carried out over a period of 15–18 months, followed by 6 months for data analysis.

Sample Size

The sample size was calculated using the formula:

$$n = z^2 \times p(1-p) / d^2$$

Where:

- $z = 1.96$ (for 95% confidence level)
- $p = 0.089$ (8.9% expected prevalence)
- $q = 1 - p = 0.911$
- $d = 0.05$ (margin of error)

Using the above parameters, the calculated sample size was 125. Considering a 10% non-response rate, the final sample size was increased to **140 patients**.

Inclusion Criteria

- Patients willing to provide informed consent for participation.
- Newly diagnosed Type 2 Diabetes Mellitus patients, with or without hypertension, attending the Medicine OPD or Emergency Department of IIMSR.
- Patients aged between **30 to 65 years**, to exclude Type 1 Diabetes Mellitus.
- Diagnosis of T2DM confirmed within **<6 months** of onset.
- Diagnosis of hypertension confirmed based on clinical history and physical examination.



Exclusion Criteria

- Patients aged <30 or >65 years.
- Pregnant women and patients with gestational diabetes or pregnancy-induced hypertension (preeclampsia/eclampsia).
- Patients with known medical renal disorders.
- Patients with known thyroid disorders (hypothyroidism or hyperthyroidism).
- Patients currently on lipid-lowering agents.
- Patients taking oral hypoglycemic agents or insulin.
- Patients with known primary hyperlipidemia.

Patient Selection and Grouping

Eligible patients presenting to the Department of Medicine were enrolled after informed consent. Based on blood pressure status, participants were divided into two groups:

- **Group A:** Newly diagnosed T2DM patients with hypertension.
- **Group B:** Newly diagnosed T2DM patients without hypertension.

Data Collection

A structured proforma was used to record the following:

- **Demographic data:** Age, gender, occupation, and dietary habits.
- **Clinical details:** Presenting complaints, duration of symptoms, history of diabetes and hypertension, and comorbidities.

Clinical Examination

All participants underwent a detailed general and systemic examination, including:

- **Vital signs:** Pulse rate and blood pressure.
 - *Pulse rate* was recorded using the palpatory method.
 - *Blood pressure* was measured using a mercury sphygmomanometer according to standard guidelines.

Biochemical Investigations

All laboratory investigations were carried out in the Central Clinical Laboratory using standard protocols:

1. Glycemic Parameters

- *Fasting Blood Sugar (FBS)* and *Postprandial Blood Sugar (PPBS)*: Measured using the glucose oxidase-peroxidase enzymatic method.
- *Glycated Hemoglobin (HbA1c)*: Measured using the HbA1c calibrator set via the immunoturbidimetric method.

2. Lipid Profile

- *Total Cholesterol, Triglycerides (TG), HDL, LDL, and VLDL*: Estimated using the CHOD-PAP method on an automated analyzer.

3. Renal Function Tests

- *Blood Urea*: Assessed using the GLDH kinetic method.
- *Serum Creatinine*: Estimated using the Jaffe's kinetic method.

4. Other Tests

- *Urine Routine Microscopy*: To detect proteinuria or signs of diabetic nephropathy.
- *Electrocardiogram (ECG)*: Performed to identify any cardiac abnormalities.

Outcome Measures

The primary objective of the study was to compare:

- The pattern and severity of dyslipidemia,
- Glycemic control (as assessed by FBS, PPBS, and HbA1c),
- Metabolic variations between hypertensive and non-hypertensive T2DM patients.

Statistical Analysis

All data were entered into Microsoft Excel and analyzed using **SPSS version 26.0** (IBM Corp.,



Armonk, NY, USA). Descriptive statistics were used to present the data:

- Continuous variables: Expressed as **mean ± standard deviation (SD)**.
- Categorical variables: Expressed as **frequencies and percentages**.

Inferential statistics:

- *Chi-square test*: Used to assess associations between categorical variables.
- *Student's t-test*: Used to compare means of continuous variables between the two groups.

A p-value of <0.05 was considered statistically significant. Further significance levels were categorized as:

- **p < 0.01**: Highly significant
- **p < 0.001**: Very highly significant

RESULTS AND OBSERVATIONS;

Table-1: Age distribution of the enrolled patients among the groups.

AGE	TYPE II DIABETES MELLITUS WITH HYPERTENSION		TYPE II DIABETES MELLITUS WITHOUT HYPERTENSION		P-VALUE
	N	%	N	%	
30-39	6	8.57%	14	20.00%	X=3.893 p=0.1428
40-49	24	34.29%	23	32.86%	
50-59	40	57.14%	33	47.14%	

The majority of patients in both groups were aged between 50–59 years, accounting for 57.14% in the hypertensive group and 47.14% in the non-hypertensive group. The proportion of younger patients (30–39 years)

was higher in the non-hypertensive group (20.00%) compared to the hypertensive group (8.57%). Although there appears to be a trend toward a higher percentage of middle-aged and older patients in the hypertensive group, the p-value (0.1428) indicates that this difference is not statistically significant.

Table 2: Gender distribution of the enrolled patients among the groups

GENDER	TYPE II DIABETES MELLITUS WITH HYPERTENSION		TYPE II DIABETES MELLITUS WITHOUT HYPERTENSION		P-VALUE
	N	%	N	%	
Female	45	64.29%	35	50.00%	X=2.917 p=0.0877
Male	25	35.71%	35	50.00%	

The gender distribution table highlights a higher percentage of females in the group with hypertension (64.29%) compared to the non-hypertensive group (50.00%). In contrast, the percentage of males is equal to females (50.00%) in the non-hypertensive group, while males account for only 35.71% in the hypertensive group. The p-value (0.0877) suggests that the observed gender difference is not statistically significant.

Table 3: Occupational distribution of the enrolled patients among the groups

OCCUPATION	TYPE II DIABETES MELLITUS WITH HYPERTENSION		TYPE II DIABETES MELLITUS WITHOUT HYPERTENSION		P-VALUE
	N	%	N	%	



	N	%	N	%
Businessman	0	0.00%	9	12.86%
Cobbler	0	0.00%	1	1.43%
Conductor	0	0.00%	1	1.43%
Driver	2	2.86%	0	0.00%
Farmer	2	2.86%	15	21.43%
Gardener	4	5.71%	0	0.00%
Guard	5	7.14%	1	1.43%
Housewife	36	51.43%	29	41.43%
Labourer	8	11.43%	5	7.14%
Landlord	4	5.71%	0	0.00%
Shopkeeper	7	10.00%	1	1.43%
Tailor	0	0.00%	3	4.29%
Teacher	2	2.86%	3	4.29%
Weaver	0	0.00%	2	2.86%

X=44.75
p<0.0001*

The occupation table shows a statistically significant difference between the two groups (p<0.0001). The hypertensive group was dominated by housewives (51.43%), guards (7.14%), and shopkeepers (10.00%). Meanwhile, the non-hypertensive group had a broader occupational spread, with a notable number of farmers (21.43%), businessmen (12.86%), and housewives (41.43%). The absence of farmers and businessmen in the hypertensive group may reflect lifestyle differences, such as physical activity, which could influence the development of hypertension in diabetic patients.

Table 4: Diet history of the enrolled patients among the groups

DIET HIST	TYPE II DIABETES MELLI	TYPE II DIABETES MELLITUS WITHOUT	P-VAL
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DIE	TUS WITH HYPERTENSION		HYPERTENSION		P-VALUE
	N	%	N	%	
Mixed Diet	54	77.14%	38	54.29%	X=8.116 p=0.0044*
Vegetarian	16	22.86%	32	45.71%	

A significant difference was observed in diet patterns between the two groups (p=0.0044). Mixed diet consumption was more common in the hypertensive group (77.14%) compared to the non-hypertensive group (54.29%). Conversely, a higher percentage of patients in the non-hypertensive group followed a vegetarian diet (45.71%) compared to the hypertensive group (22.86%).

Table: 5 Surgical history among the enrolled patients in both groups

SURGICAL HISTORY	TYPE II DIABETES MELLITUS WITH HYPERTENSION		TYPE II DIABETES MELLITUS WITHOUT HYPERTENSION		P-VALUE
	N	%	N	%	
No	70	100.00%	70	100.00%	-

All patients in both groups reported no history of prior surgery (100% in both groups).



Table: 6 Family history of diabetes among the enrolled patients in both groups

FAMILY HISTORY	TYPE II DIABETES MELLITUS WITH HYPERTENSION		TYPE II DIABETES MELLITUS WITHOUT HYPERTENSION		P-VALUE
	N	%	N	%	
No	49	70.00%	48	68.57%	X=0.357 p=0.8546
Yes	21	30.00%	22	31.43%	

A similar proportion of patients in both groups reported a positive family history of diabetes (30.00% in the hypertensive group and 31.43% in the non-hypertensive group). The majority of patients in both groups had no family history of diabetes (70.00% and 68.57%, respectively). The p-value (0.8546) indicates no statistically significant difference in family history between the groups.

Table 7: Anthropometric parameters of the enrolled patients among the groups

ANTHROPOMETRIC PARAMETERS	TYPE II DIABETES MELLITUS WITH HYPERTENSION	TYPE II DIABETES MELLITUS WITHOUT HYPERTENSION	P-VALUE
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	MEAN	SD	MEAN	SD	
Height (m)	1.66	.05	1.65	.05	t=0.775 p=0.42
Weight (kg)	76.75	5.74	73.81	4.31	t=1.354 p=0.1645
BMI (kg/m ²)	28.63	2.29	27.00	1.39	t=2.622 p=0.2525
Waist Circumference	94.60	8.08	92.94	7.19	t=0.841 p=0.54
Waist hip Ratio	.90	.03	.87	.05	t=0.1487 p=0.448
Abdominal Girth size (inches)	38.17	2.91	36.24	2.83	t=1.445 p=0.1567

While the mean values for all parameters—height, weight, BMI, waist circumference, waist-hip ratio, and abdominal girth—are slightly higher in the hypertensive diabetic group, none of the differences reached statistical significance ($p > 0.05$ for all parameters). Notably, the BMI was higher in the hypertensive group (28.63 ± 2.29) compared to the non-hypertensive group (27.00 ± 1.39), with the highest t-value ($t = 2.622$), suggesting a trend toward significance, though the p-value (0.2525) indicates the difference is not statistically significant. These findings imply that while



hypertensive diabetic patients tend to have slightly higher anthropometric measures.

Table 8: Glycemic parameters of the enrolled patients among the groups

Glycemic Parameters	TYPE II DIABETES MELLITUS WITH HYPERTENSION		TYPE II DIABETES MELLITUS WITHOUT HYPERTENSION		P-VALUE
	MEAN	SD	MEAN	SD	
HbA1C	9.73	2.04	9.16	2.71	t=1.406 p=0.1619
Fasting	224.57	92.87	197.10	68.81	t=1.988 p=0.0487*
PP	266.97	88.90	240.59	66.69	t=1.986 p=0.0490*

Glycemic parameters showed significant differences in fasting plasma glucose ($p=0.0487$) and postprandial plasma glucose ($p=0.0490$), with higher mean values in the hypertensive group (224.57 mg/dL and 266.97 mg/dL, respectively) compared to the non-hypertensive group (197.10 mg/dL and 240.59 mg/dL, respectively). HbA1c was also higher in the hypertensive group (9.73% vs. 9.16%), though not statistically significant. This suggests that patients with hypertension may have poorer glycemic control compared to those without hypertension.

Table 9: Lipids parameters of the enrolled patients among the groups

LIPIDS PROFILE	TYPE II DIABETES MELLITUS WITH HYPERTENSION		TYPE II DIABETES MELLITUS WITHOUT HYPERTENSION		P-VALUE
	MEAN	SD	MEAN	SD	
T. Cholesterol	180.11	35.50	153.87	69.99	t=2.797 p=0.0059*
Triglyceride	215.94	69.73	178.47	60.17	t=2.228 p=0.031*
HDL	37.27	12.22	35.16	13.86	t=0.954 p=0.3411
Cholesterol/HDL	5.18	1.56	4.69	2.76	t=1.293 p=0.1981
LDL	104.85	33.45	85.43	42.76	t=2.993 p=0.0033*
VDL	31.98	20.75	40.17	15.35	t=2.655 p=0.0089*

Total cholesterol levels were significantly higher in the DM + HTN group (180.11 ± 35.50 mg/dL) compared to the DM - HTN group (153.87 ± 69.99 mg/dL) with a t-value of 2.797 and a p-value of 0.0059, indicating statistical significance. Similarly, triglyceride levels were elevated in the DM + HTN group (215.94 ± 69.73 mg/dL) compared to the DM - HTN group (178.47 ± 60.17 mg/dL), with a t-value of 2.228 and a p-value of 0.031. LDL cholesterol was also significantly higher in the DM + HTN group (104.85 ± 33.45 mg/dL) than in



the DM - HTN group (85.43 ± 42.76 mg/dL), showing statistical significance ($t=2.993$, $p=0.0033$). Additionally, VLDL levels were higher in the DM + HTN group (40.17 ± 15.35 mg/dL) compared to the DM - HTN group (31.98 ± 20.75 mg/dL) with a significant t-value of 2.655 and p-value of 0.0089. And, HDL cholesterol ($t=0.9554$, $p=0.3411$) and the Cholesterol/HDL ratio ($t=1.293$, $p=0.1981$) did not show significant differences between the groups.

Table 10: Vitals of the enrolled patients among the groups

VITALS	TYPE II DIABETES MELLITUS WITH HYPERTENSION		TYPE II DIABETES MELLITUS WITHOUT HYPERTENSION		P-VALUE
	MEAN	SD	MEAN	SD	
HEART RATE	85.17	9.51	82.1	6.91	$t=1.433$ $p=0.158$
SBP	164.87	18.83	117.14	7.39	$t=19.74$ $p<0.0001$ *
DBP	98.76	11.98	77.38	6.62	$t=13.07$ $p<0.0001$ *

DISCUSSION

The present study examined the comparative pattern of dyslipidemia and glycemic control in newly diagnosed Type 2 Diabetes Mellitus (T2DM) patients with and without hypertension. The findings indicate that hypertensive diabetic patients exhibited significantly worse lipid profiles and higher glycemic indices compared to their non-hypertensive counterparts.

In this study, **total cholesterol, triglycerides, LDL, and VLDL levels** were significantly higher in the hypertensive diabetic group. These findings are consistent with previous studies that have reported an aggravation of diabetic dyslipidemia in the presence of hypertension [8,9]. The underlying mechanism is believed to involve enhanced insulin resistance and increased sympathetic nervous activity, which contribute to lipolysis and the release of free fatty acids, thereby increasing hepatic triglyceride synthesis and VLDL production [10].

Interestingly, **HDL levels** did not significantly differ between the two groups. While low HDL is a common feature of diabetic dyslipidemia, its relationship with hypertension remains inconsistent across different populations and studies [11].

Glycemic parameters such as **fasting and postprandial glucose** were significantly elevated in the hypertensive diabetic group. Although the **HbA1c** levels were higher in this group as well, the difference did not reach statistical significance. These results suggest that hypertension may be associated with poorer glycemic control in newly diagnosed diabetic patients, possibly due to shared pathophysiological pathways such as endothelial dysfunction and inflammation [12].

The **anthropometric data**, including BMI and waist circumference, showed higher mean values in the hypertensive group, although not statistically significant. Central obesity, a hallmark of metabolic syndrome, is known to contribute to both hypertension and diabetes, and its higher prevalence in the hypertensive group may partially explain the worsened metabolic profile [13].

Dietary patterns also showed significant variation. A higher proportion of hypertensive patients consumed a mixed diet, while more non-hypertensive patients were vegetarians. Studies have shown that plant-based diets are associated with lower blood pressure and better lipid profiles, which may have contributed to the observed differences [14].



The **occupational distribution** suggested a significant lifestyle component. A higher number of non-hypertensive diabetic patients were farmers or engaged in physically demanding jobs, while the hypertensive group included more sedentary roles such as housewives and shopkeepers. This difference in physical activity levels likely plays a role in the metabolic differences observed [15].

No statistically significant differences were found in **gender distribution, age, or family history** of diabetes between the groups, suggesting that the dyslipidemic differences are more closely related to hypertension status and lifestyle factors rather than genetic predisposition alone.

Overall, this study reinforces the concept of hypertension as a metabolic amplifier in diabetic patients. The coexistence of hypertension in T2DM patients correlates with a more atherogenic lipid profile and poorer glycemic parameters, emphasizing the need for early and aggressive cardiovascular risk management in this population.

CONCLUSION

This study highlights a significant association between hypertension and worsened glycemic control and lipid profile among newly diagnosed Type 2 Diabetes Mellitus (T2DM) patients. Patients with coexisting hypertension exhibited significantly higher levels of fasting and postprandial blood glucose, total cholesterol, triglycerides, LDL, and VLDL compared to their non-hypertensive counterparts. These findings suggest that hypertension in diabetic patients may contribute to an increased risk of cardiovascular complications through exacerbation of dyslipidemia. Therefore, early identification and aggressive management of both hypertension and dyslipidemia are essential components of comprehensive care in newly diagnosed T2DM patients to reduce long-term morbidity and mortality.

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