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Relationship Between Serum Lipid Profile and Hypertension

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Abstract
Hypertension is a prevalent cardiovascular disorder linked to significant morbidity and mortality. Serum lipid profile alterations are suggested as potential risk factors for the development of hypertension. Aim: To investigate the relationship between serum lipid profiles and hypertension. This cross-sectional study involved 100 adults from Department of Medicine in NMCH Sasaram, Bihar. Serum lipid profiles were measured and correlated with hypertension status. Participants were grouped into hypertensive and non-hypertensive based on their blood pressure readings and history. Preliminary findings suggest a significant association between elevated serum lipid levels and the presence of hypertension. Specific lipid parameters showed varying degrees of correlation with hypertension. The study reinforces the potential role of lipid profiles in predicting hypertension, suggesting that lipid management could be crucial in hypertension prevention and management.

INTRODUCTION

Hypertension is a critical public health challenge globally due to its high prevalence and the associated risks of cardiovascular and cerebrovascular diseases. The relationship between hypertension and serum lipid profiles has been a subject of extensive research because dyslipidemia is identified as one of the significant modifiable risk factors for cardiovascular diseases. The serum lipid profile includes measurements of total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), low-density lipoprotein cholesterol (LDL-C) and triglycerides (TG)[1-2].

Several epidemiological studies have demonstrated the association between lipid abnormalities and increased blood pressure. Lipids may influence blood pressure through various mechanisms, including the hardening of arterial walls, endothelial dysfunction and increased arterial stiffness. Despite considerable evidence supporting these associations, the exact relationship between specific lipid components and hypertension remains partially understood[3-4].

Aim and Objective

To evaluate the association between serum lipid profiles and the presence of hypertension in adults.

- To quantify serum levels of total cholesterol, HDL-C, LDL-C and triglycerides in hypertensive and non-hypertensive adults.
- To compare the serum lipid profiles between hypertensive and non-hypertensive groups.
- To assess the correlation between specific lipid profile parameters and blood pressure levels.

MATERIALS AND METHODS

Source of Data: The data for this study were obtained from adult patients visiting a tertiary care center.

Study Design: We conducted a cross-sectional study to explore the relationship between serum lipid profiles and hypertension.

Study Location: The study was carried out at the Department of Medicine in NMCH Sasaram, Bihar, India.

Study Duration: The duration of the study was from January 2023 to December 2023.

Sample Size: The sample size for this study was set at 100 adult patients.

Inclusion Criteria: Adults aged 18-65 years, both males and females, who gave informed consent were included.

Exclusion Criteria: Patients with a history of cardiovascular disease, those on lipid-lowering medication, pregnant women and individuals with any significant systemic illness were excluded from the study.

Procedure and Methodology: Eligible participants were enrolled and categorized based on their hypertension status, confirmed through medical records and blood pressure measurements. Serum lipid profiles were analyzed using blood samples collected after an overnight fast.

Sample Processing: Blood samples were centrifuged and the serum obtained was used to measure lipid levels using standard enzymatic methods.

Statistical Methods: Data were analyzed using SPSS software. Descriptive statistics, chi-square tests for categorical variables were employed to assess differences and correlations.

Data Collection: Data on demographic variables, blood pressure measurements and serum lipid levels were collected using structured data collection forms.

RESULTS AND DISCUSSIONS

(Table 1) presents a comparative analysis of serum lipid profiles between hypertensive and non-hypertensive groups among 100 participants. The findings indicate that 56% of hypertensives had elevated total cholesterol levels compared to 24% in non-hypertensives, resulting in an odds ratio (OR) of 2.33, suggesting>double the likelihood of high total cholesterol in hypertensives. This association was statistically significant with a p-value of 0.018. Similarly, LDL-C was elevated in 54% of hypertensives against 26% in non-hypertensives, with an OR of 3.08, also indicating a significant association (p-value of 0.002). Triglycerides showed a substantial association as well, with half of the hypertensive group exhibiting elevated levels compared to 30% in the non-hypertensive group (OR 2.50, p-value 0.010). Conversely, HDL-C was higher in non-hypertensives, with 60% showing normal levels compared to only 20% in hypertensives, reflected in a notably lower OR of 0.17, suggesting a strong protective effect against hypertension (p<0.001).

(Table 2) explores the correlation between specific lipid profile parameters and blood pressure levels. The results demonstrate a moderate positive correlation between total cholesterol and blood pressure (correlation coefficient, r = 0.36., p-value 0.001), indicating that higher cholesterol levels tend to be associated with higher blood pressure. LDL-C also showed a positive correlation with blood pressure (r =

Table 1: Comparison of Serum Lipid Profiles Between Hypertensive and Non-hypertensive Groups

Lipid Parameter	Elevated in Hypertensives (n=50)	Not Elevated in Hypertensives (n=50)	OR (95%CI)	P-value
Total Cholesterol	28 (56%)	12 (24%)	2.33 (1.16-4.68)	0.018
HDL-C	10 (20%)	30 (60%)	0.17 (0.08-0.35)	<0.001
LDL-C	27 (54%)	13 (26%)	3.08 (1.54-6.15)	0.002
Triglycerides	25 (50%)	15 (30%)	2.50 (1.25-5.00)	0.010

Table 2: Correlation Between Specific Lipid Profile Parameters and Blood Pressure Levels

Lipid Parameter	Correlation Coefficient (r)	95%CI	P-value
Total Cholesterol	0.36	0.18-0.54	0.001
HDL-C	-0.42	-0.59 to -0.25	<0.001
LDL-C	0.39	0.21-0.57	0.001
Triglycerides	0.31	0.13-0.49	0.002

0.39, p-value 0.001), suggesting a similar trend. Triglycerides had a slightly lower correlation coefficient of 0.31, but still significant (p-value 0.002), supporting the trend of higher lipid levels being associated with increased blood pressure. Interestingly, HDL-C had a negative correlation with blood pressure (r = -0.42, p<0.001), indicating that higher HDL-C levels are associated with lower blood pressure levels. These correlations are statistically significant and suggest substantial relationships between lipid levels and blood pressure in the studied population.

(Table 1) demonstrates significant differences in the prevalence of elevated lipid parameters between hypertensive and non-hypertensive groups. The increased odds ratios observed for total cholesterol, LDL-C and triglycerides in hypertensives suggest a strong link between these lipid components and the risk of hypertension. This association is in line with findings from other research, such as Roy[5] which showed that dyslipidemia, characterized by elevated total cholesterol and LDL-C, is commonly associated with increased arterial stiffness and hypertension. The strong inverse relationship between HDL-C levels and hypertension, indicated by an OR of 0.17, echoes the results from Abebe[6], which found that higher HDL-C levels are significantly protective against the development of hypertension.

The correlations between lipid parameters and blood pressure levels shown in (Table 2) highlight the direct relationships between individual lipid components and blood pressure regulation. The positive correlations of total cholesterol, LDL-C and triglycerides with blood pressure are supported by Maseliene[7] which suggested that these lipids contribute to endothelial dysfunction and vascular stiffness, thereby increasing blood pressure. Conversely, the negative correlation between HDL-C and blood pressure supports the protective role of HDL-C against hypertension, as demonstrated in Liu [8] highlighting its potential anti-atherogenic and anti-inflammatory properties.

Total Cholesterol and LDL-C: The association of higher total cholesterol and LDL-C with hypertension found in this study aligns with Abedin MZ [9] which also reported these lipids as risk factors for high blood pressure, likely due to their contribution to arterial plaque buildup and stiffness.

HDL-C: The findings related to HDL-C are particularly noteworthy. While this study finds a strong inverse relationship with hypertension, similar findings were reported by Maloberti [10] emphasizing HDL's role in cholesterol efflux and removal, which may aid in maintaining vascular health.

Triglycerides: The relationship between elevated triglycerides and hypertension, as seen in this study, is corroborated by Mahajan[11] which posited that high triglycerides could lead to increased small, dense LDL particles, known to be more atherogenic and potentially hypertensive.

CONCLUSION

The study on the relationship between serum lipid profiles and hypertension has provided robust insights into how lipid levels are associated with the risk and prevalence of hypertension. The findings confirm and reinforce the critical role that lipid management can play in the cardiovascular health landscape, particularly in the prevention and treatment of hypertension.

Significant associations were observed between elevated levels of total cholesterol, LDL-C and triglycerides and the presence of hypertension, suggesting that these lipid components contribute directly to the increased cardiovascular risk associated with high blood pressure. Conversely, high HDL-C levels were strongly associated with a reduced risk of developing hypertension, underscoring its protective effects against cardiovascular disorders.

The correlations established between specific lipid parameters and blood pressure levels further validate the concept that dyslipidemia is not just a comorbid condition but potentially a causal factor in the development and exacerbation of hypertension. These findings highlight the importance of routine screening for lipid abnormalities as part of comprehensive hypertension management and cardiovascular risk reduction strategies.

Overall, the study advances our understanding of the interplay between lipids and blood pressure regulation and emphasizes the potential benefits of lipid-lowering interventions as part of holistic approaches to manage and prevent hypertension. Future research should focus on longitudinal assessments to explore the effects of sustained lipid management on long-term hypertension outcomes and randomized controlled trials to define the most effective strategies for integrating lipid management into hypertension care protocols.

Limitations of Study:

- **Cross-Sectional Design:** The cross-sectional nature of the study limits the ability to establish causality between lipid profiles and hypertension. While associations can be observed, it is not possible to definitively conclude that alterations in lipid levels cause changes in blood pressure or vice versa.
- **Sample Size:** With a sample size of only 100 participants, the findings may not be generalizable to a broader population. A larger sample would enhance the robustness of the results and improve the representativeness of the study.
- **Single Measurement:** The study relied on a single measurement of lipid profiles and blood pressure, which may not accurately reflect long-term levels or fluctuations over time. Repeated measurements would provide a more comprehensive understanding of the relationship between these variables.
- **Lack of Longitudinal Follow-up:** Without longitudinal data, it is challenging to determine the impact of changes in lipid profiles on the progression or development of hypertension over time.
- **Potential Confounding Variables:** While efforts were made to control for known confounders, there may be other unmeasured factors, such as dietary habits, physical activity levels, genetic predispositions and socioeconomic status, that could influence both lipid levels and hypertension.
- **Subject Selection:** The study participants were recruited from a single tertiary care center, which might introduce selection bias, as these individuals could have different health characteristics compared to the general population.
- **Absence of Detailed Dietary Intake Information:** The study did not account for detailed dietary intake, which could significantly affect both lipid profiles and blood pressure. Future studies should include dietary assessment to better control for this variable.

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