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Association of Dyslipidemia with Traditional Cardiovascular Risk Factors and Framingham Risk Scoring

Dr. Maleka Ali[1*], Dr. Md. Jahangir Alam Prodhan[2], Dr. Sarif Mahammad Salauddin[3], Dr. Shegufta Mishket Mukerrama[4], Md. Al-Amin[5]

[1]Medical Officer, Department of Nephrology, National Institute of Kidney Diseases and Urology, Dhaka, Bangladesh
[2]Regional Consultant (FPCS-QIT), Dhaka Region, CCSDP Unit, Directorate General of Family Planning, Medical Education & Family Welfare Division, Ministry of Health & Family Welfare, Bangladesh
[3]Medical Officer, Department of Nephrology, Sir Salimullah Medical College and Mitford Hospital, Dhaka, Bangladesh
[4]Medical Officer, Department of Nephrology, Dhaka Medical College Hospital, Dhaka, Bangladesh
[5]Assistant Professor, Department of Cardiology, Bangladesh Medical University, Dhaka, Bangladesh

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***Corresponding author:** Dr. Maleka Ali
Medical Officer, Department of Nephrology, National Institute of Kidney Diseases and Urology, Dhaka, Bangladesh

Abstract

Background: Dyslipidemia is a key modifiable risk factor for cardiovascular disease (CVD) and is highly prevalent among renal transplant recipients (RTRs). Traditional cardiovascular risk factors, such as hypertension, diabetes, and obesity, contribute to adverse cardiovascular outcomes. The Framingham Risk Score (FRS) is a widely used tool to estimate coronary heart disease (CHD) risk, incorporating lipid levels and other major risk factors. However, the association between dyslipidemia, traditional cardiovascular risk factors, and FRS in RTRs remains unclear. ***Objective:*** This study aimed to assess the relationship between dyslipidemia and traditional cardiovascular risk factors in RTRs and to evaluate the impact of dyslipidemia on FRS. ***Methodology:*** A cross-sectional observational study was conducted over 13 months (May 2019 – June 2020) at nephrology departments of multiple healthcare facilities in Bangladesh. A total of 105 RTRs, selected through purposive sampling, underwent clinical assessments, laboratory investigations, and FRS calculation. The prevalence of dyslipidemia was evaluated, and its associations with hypertension, diabetes, body mass index (BMI), and FRS were analyzed using SPSS version 16. ***Results:*** The majority of RTRs were male (88.6%) and aged ≤40 years (72.4%). Dyslipidemia was highly prevalent, affecting 88.0% of hypertensive patients, 100.0% of diabetics, and 100.0% of underweight and obese individuals. However, no statistically significant associations were found between dyslipidemia and hypertension ($p = 0.498$), diabetes ($p = 0.455$), or BMI ($p = 0.470$). Similarly, dyslipidemia did not show a significant correlation with FRS ($p = 0.107$), despite its high prevalence across all FRS categories. ***Conclusion:*** Dyslipidemia is highly prevalent among RTRs but is not significantly associated with traditional cardiovascular risk factors or FRS. These findings suggest that conventional cardiovascular risk models may not fully capture the complex risk profile of RTRs. Individualized lipid monitoring and tailored cardiovascular risk management strategies are essential for optimizing post-transplant care. Further studies with larger sample sizes and longitudinal designs are needed to elucidate the interplay between dyslipidemia, immunosuppressive therapy, and cardiovascular risk in RTRs.

Keywords: Dyslipidemia, Renal Transplant Recipients, Cardiovascular Risk, Framingham Risk Score.

INTRODUCTION

Cardiovascular diseases (CVDs) remain a leading cause of mortality worldwide, with dyslipidemia being a significant modifiable risk factor. Dyslipidemia, characterized by abnormal levels of lipids in the blood, including elevated total cholesterol, low-density lipoprotein cholesterol (LDL-C), triglycerides, and reduced high-density lipoprotein cholesterol (HDL-C), is strongly associated with atherosclerosis and other cardiovascular complications. Traditional cardiovascular risk factors such as hypertension, diabetes mellitus, smoking, obesity, and sedentary lifestyles further exacerbate the impact of dyslipidemia, collectively increasing the likelihood of adverse cardiac events [1-4].

The Framingham Risk Score (FRS), developed from the long-term Framingham Heart Study, is a widely used tool to estimate an individual's 10-year risk of developing coronary heart disease (CHD). This scoring system incorporates key cardiovascular risk factors, including age, sex, lipid levels, blood pressure, smoking status, and diabetes, to provide a quantitative assessment of risk. Given that dyslipidemia is a core component of this model, its association with other traditional risk factors significantly influences an individual's overall cardiovascular risk profile [5-6].

Numerous epidemiological studies have highlighted the interrelationship between dyslipidemia and other traditional cardiovascular risk factors. For instance, individuals with hypertension often exhibit lipid abnormalities, while diabetic patients frequently present with atherogenic dyslipidemia, characterized by high triglycerides and low HDL-C. Similarly, lifestyle factors such as smoking and obesity contribute to both lipid imbalances and endothelial dysfunction, further accelerating atherosclerotic changes [7,8]. These overlapping risk factors underscore the necessity of a comprehensive approach to cardiovascular risk assessment and management.

Despite advancements in preventive cardiology, dyslipidemia remains a prevalent issue, particularly in populations with increasing rates of metabolic syndrome and lifestyle-related disorders. Understanding its contribution to cardiovascular risk in conjunction with other traditional factors can help optimize risk stratification and guide targeted therapeutic interventions. The application of Framingham Risk Scoring in clinical settings facilitates early identification of high-risk individuals, allowing for timely lifestyle modifications and pharmacological treatments.

Objective

This study aims to explore the association of dyslipidemia with traditional cardiovascular risk factors and its impact on Framingham Risk Scoring. By examining existing evidence, we seek to emphasize the importance of integrated risk assessment strategies to mitigate the growing burden of cardiovascular disease.

METHODOLOGY

Type of Study

This study was designed as an observational cross-sectional study to evaluate the prevalence of renal transplant recipients in selected healthcare facilities in Bangladesh.

Place of Study

The research was conducted in the Department of Nephrology at Sir Salimullah Medical College & Mitford Hospital, Dhaka, as well as at the CKD and Urology Hospital (CKD&U) and the Kidney Foundation Hospital and Research Institute, Bangladesh.

Study Period

The study was carried out over a period of 13 months, from May 2019 to June 2020.

Study Population

The target population consisted of renal transplant recipients who attended the Department of Nephrology at CKD&U and the Kidney Foundation Hospital and Research Institute, Bangladesh.

Sample Size

Sample size was 368. However, due to the limited availability of renal transplant recipients and time constraints, a total of 105 patients were included in the study.

Sampling Technique

A purposive sampling method was employed. After selecting eligible participants, detailed clinical histories and medical records were collected. A structured data collection sheet was used to document relevant information, and necessary laboratory investigations were performed.

Selection Criteria

Inclusion Criteria:

- Patients aged 18 years or older
- Minimum 3 months post-renal transplantation

Exclusion Criteria:

- Patients taking lipid-lowering drugs
- Acute graft rejection within <3 months
- Patients with cognitive impairment
- Terminally ill patients

Study Procedure

Renal transplant recipients attending CKD&U and the Kidney Foundation Hospital were identified from hospital registries. Participants were contacted and scheduled for appointments. After obtaining informed consent, patients were instructed to fast for 10 hours before arriving for clinical assessment.

Each participant underwent a comprehensive medical history review, clinical examination, and laboratory investigations. The following parameters were assessed: fasting lipid profile, serum creatinine, fasting blood glucose, spot urine ACR, CRP, and eGFR (calculated using the MDRD equation). Additionally, serum Apo B, Apo A-I, and lipoprotein (a) levels were measured. The Framingham risk score was also calculated for each patient.

Data Collection Tools

A semi-structured questionnaire was designed to capture socio-demographic details, clinical information, and laboratory findings. The questionnaire

was developed based on the study objectives and included structured questions for ease of data collection.

Sampling and Laboratory Analysis

Blood Sample Collection:

A 10 mL venous blood sample was collected after an overnight fast of at least 10 hours.

- 2 mL of whole blood was separated for fasting blood glucose (FBS).
- The remaining blood was allowed to clot, centrifuged at 3000 rpm for 15 minutes, and stored at -80°C until analysis.
- Urine samples were also collected and centrifuged for biochemical examination.

Laboratory Methods:

- Serum creatinine was measured using the immunoturbidimetric method with an automated analyzer (ERVA-XL-200).
- Urinary ACR was determined using a spot urine sample, calculating albumin-to-creatinine ratio.
- FBS was analyzed using an automated biochemistry analyzer.
- Total cholesterol, triglycerides, HDL-C, and LDL-C were measured using enzymatic methods.
- Apo A-I and Apo B were assessed via immunoturbidimetry using an automated chemistry analyzer (Mindray-BS-230).
- Lipoprotein (a) levels were determined using the immunoturbidimetric method.
- Serum CRP was measured using the turbidimetric latex agglutination method (Biosystems, Spain).

Data Management

All data were meticulously compiled, screened, and checked for completeness and consistency. Missing data and discrepancies were identified and corrected before statistical analysis.

Statistical Analysis

Data were systematically recorded using a pre-designed data collection sheet. Statistical analysis was performed using SPSS version 16 (Chicago, IL, USA). Quantitative data were presented as mean ± standard deviation (SD), while qualitative data were expressed as frequency and percentage. Appropriate statistical techniques were applied to analyze the results.

RESULTS

Most of the renal transplant recipients were below or equal to 40 years of age(72.4%). Mean age of the RTRs was 34.7 ± 8.9 years. Males were predominant than females. Male to female ratio was 7.75:1.

Table-I: Age and gender distribution of the study group

	Frequency (n)	Percentage (%)
Age (years)		
≤30	40	38.1
31 – 40	36	34.3
41 – 50	23	21.9
>50	6	5.7
Gender		
Male	93	88.6

The table below presents the distribution of dyslipidemia and non-dyslipidemia across various cardiovascular risk factors, along with their respective p-values. Among hypertensive individuals, 88.0% had dyslipidemia, while 85.0% of non-hypertensive individuals also had dyslipidemia (p = 0.498). Similarly, all diabetic individuals (100.0%) had dyslipidemia, whereas 85.0% of non-diabetics were dyslipidemic (p = 0.455). Regarding body mass index (BMI), dyslipidemia was observed in 100.0% of underweight and obese individuals, while it was slightly lower in the normal BMI (83.3%) and overweight (85.7%) groups (p = 0.470).

Table II: Association between dyslipidemia status and cardiovascular risk factors (N=105)

	Dyslipidemia Status		
Variables	**Dyslipidemia**	**Non-dyslipidemia**	**p-value**
Hypertensive Non hypertensive	88.0% 85.0%	12.0% 15.0%	0.498
Diabetic Non diabetic	100.0% 85.0%	0 15.0%	.455
Body Mass Index(kg/m^2) Underweight (<18.5)	 100.0%	 0	.470

Normal (18.5-24.9)	83.3%	16.7%	
Over weight (25-29.9)	85.7%	14.3%	
Obesity (≥30)	100.0%	0	

Table demonstrate no significant association between dyslipidaemia and Framingham risk scoring. Chi-Square test was done to measure the level of significance.

Table III: Association of dyslipidemia and Framingham risk scoring (N=105)

	Dyslipidemia Status		
Variables	**Dyslipidemia**	**Non-dyslipidemia**	**p-value**
FR scoring			.107
Low	87.0%	13.0%	
Moderate	50.0%	50.0%	
High	100.0%	0	

DISCUSSION

Dyslipidemia is a well-recognized risk factor for cardiovascular disease (CVD), especially in renal transplant recipients (RTRs). In this study, the prevalence of dyslipidemia among RTRs was high, but no significant associations were found between dyslipidemia and traditional cardiovascular risk factors such as hypertension, diabetes, and body mass index (BMI). These findings are consistent with some previous studies but contrast with others that have reported a strong correlation between dyslipidemia and these risk factors. A study found that hypertension and diabetes were significantly associated with dyslipidemia in RTRs, contributing to an increased risk of cardiovascular events [9]. However, in our study, although a higher percentage of hypertensive (88.0%) and diabetic (100.0%) patients had dyslipidemia, the associations were not statistically significant. This discrepancy may be due to the relatively small sample size or differences in study populations, including variations in immunosuppressive therapy and post-transplant care. Similarly, BMI is often linked to dyslipidemia, with obesity being a major contributor to lipid abnormalities. Studies have reported a strong correlation between obesity and dyslipidemia in RTRs [10].

In contrast, our study found that dyslipidemia was present in all underweight and obese participants but was slightly lower in normal-weight (83.3%) and overweight (85.7%) individuals, with a non-significant p-value (0.470). This suggests that other factors, such as metabolic disturbances and immunosuppressive drugs, may play a greater role in dyslipidemia among RTRs than BMI alone. The association between dyslipidemia and cardiovascular risk scoring, as assessed by the Framingham Risk Score (FRS), also did not reach statistical significance in our study (p = 0.107). However, 87.0% of individuals with a low FRS, 50.0% with a moderate FRS, and 100.0% with a high FRS had dyslipidemia. Previous research has shown that RTRs tend to have an increased cardiovascular risk despite normal or moderate FRS values, as renal dysfunction itself is an independent risk factor for CVD [11]. A study highlighted that traditional risk scores might underestimate cardiovascular risk in RTRs due to transplant-specific factors such as chronic inflammation, immunosuppressive drug effects, and altered lipid metabolism [12]. Overall, while our study did not find significant associations between dyslipidemia and traditional cardiovascular risk factors, it underscores the high prevalence of dyslipidemia in RTRs. This aligns with previous studies suggesting that conventional risk models may not fully capture the complex cardiovascular risks in this population. Future research with larger sample sizes and longitudinal follow-up is needed to better understand the intricate interplay between dyslipidemia and cardiovascular health in RTRs.

CONCLUSION

Our study highlights the high prevalence of dyslipidemia among renal transplant recipients (RTRs); however, no statistically significant associations were found between dyslipidemia and traditional cardiovascular risk factors such as hypertension, diabetes, and body mass index (BMI). Additionally, dyslipidemia did not show a significant correlation with Framingham Risk Scores (FRS), suggesting that conventional cardiovascular risk assessment tools may not fully capture the unique risk profile of RTRs. These findings emphasize the need for individualized lipid monitoring and cardiovascular risk management strategies tailored to post-transplant patients. Further studies with larger sample sizes and longitudinal designs are necessary to explore the complex interplay between dyslipidemia, immunosuppressive therapy, and cardiovascular risk in RTRs.

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