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Assessment Of Cardiovascular Risk In Diabetic And Dyslipidemic Patients Using Qrisk2 Score

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ABSTRACT:

BACKGROUND: Cardiovascular diseases (CVDs) are the leading cause of death worldwide. This study aimed to evaluate the risk of cardiovascular disease among patients with dyslipidemia and diabetes, as well as to identify potential drug interactions among the prescribed medications.

METHODS AND MATERIALS: A prospective observational study was carried out over six months in the inpatient departments of Cardiology and General Medicine. The study included patients aged 40–70 years with no prior evidence of cardiovascular disease (CVD). The 10-year cardiovascular risk was assessed using the QRISK2 scoring system.

RESULTS: The mean age of male participants was 58.08 ± 7.25 years, while for females, it was 56.87 ± 6.82 years. The average body mass index (BMI) fell within the pre-obese range. Hypertension was observed in 34% of patients, 65% had no history of smoking, and 38% had a positive family history of cardiovascular disease (CVD). Fasting blood sugar levels were higher in males compared to females. Female participants exhibited higher mean levels of low-density lipoprotein cholesterol (LDLc), non-high-density lipoprotein cholesterol (non-HDLc), and total cholesterol-to-high-density lipoprotein cholesterol (TC/HDL) ratio compared to males. High cardiovascular risk was identified in 69.2% of males and 70.8% of females. Additionally, 19 drug-drug interactions were documented, with 47.36% of the prescriptions involving interactions of major severity.

CONCLUSION: Risk stratification is crucial for the effective prevention and management of cardiovascular diseases (CVD). Larger-scale, multicenter, and population-based studies could be conducted to enable more tailored cardiovascular risk assessments.

KEY WORDS: Cardiovascular disease, QRISK2, Primary prevention, Cardiovascular risk score, Coronary Heart Disease

INTRODUCTION:

Cardiovascular diseases (CVDs) impose a significant health and economic burden and rank among the leading causes of death worldwide.[1] According to the Global Burden of Disease (GBD) study, coronary heart disease (CHD) accounts for 30% of all deaths in developing countries.[2] Notably, approximately 80% of cardiovascular diseases are considered preventable. Atherosclerosis is the primary cause of CVD, contributing to conditions such as myocardial infarction, stroke, peripheral artery disease, and heart failure. Dyslipidemia is a major risk factor for atherosclerosis, alongside other factors such as diabetes, hypertension, smoking, physical inactivity, obesity, poor dietary habits, and excessive alcohol consumption.

Evaluating risk factors and estimating the likelihood of future atherosclerotic events are critical for the primary prevention of cardiovascular disease (CVD). To aid clinicians in assessing long-term CVD risks, various risk assessment tools have been developed. Among these, QRISK2 is one of the most well-known and widely used models. Developed in the United Kingdom by Collins et al.,[3] QRISK2 is a multifactorial algorithm designed to predict 10-year cardiovascular risk.

The QRISK2 score incorporates parameters such as age, gender, ethnicity, smoking status, diabetes, systolic blood pressure, a history of angina in first-degree relatives under 60 years, chronic kidney disease (CKD) stage, atrial fibrillation, existing antihypertensive therapy, rheumatoid arthritis, total cholesterol to HDL cholesterol (TC/HDLc) ratio, and body mass index (BMI). These parameters are easily measurable in the general population and have been validated by comparing observed outcomes with predicted risks at the population level.[4]

Based on the QRISK2 scores, individuals are classified into three risk categories: low, moderate, and high risk. A score below 10% indicates low risk, a score between 10% and 20% indicates moderate risk, and a score exceeding 20% indicates high risk.

By collaborating closely with patients and physicians, pharmacists can deliver advanced care that supports effective condition management. Providing long-term care not only enhances patients' quality of life but also reduces cardiovascular events, ultimately lowering overall healthcare costs. With these goals in mind, this study was designed to identify high-risk groups for cardiovascular disease (CVD) among dyslipidemic and diabetic patients using the QRISK2 score. Additionally, the study aimed to identify potential drug interactions among prescribed medications and provide counseling to high-risk individuals through patient information leaflets.[5]

MATERIALS AND METHODS :

A prospective observational study was conducted over a six-month period in the inpatient departments of Cardiology and General Medicine. The study received approval from the hospital's ethical committee, and written informed consent was obtained from each participant. The sample size was calculated based on a population size of 135, a confidence interval of 5, and a confidence level of 95%.

Patient details, including age, sex, reasons for admission, and social history, were recorded in a standardized proforma. A comprehensive clinical history was obtained, followed by a complete physical examination, which included anthropometric measurements and a thorough cardiovascular assessment to detect any signs of cardiac disease. Venous blood samples were collected for biochemical analysis, including random blood sugar levels, HbA1c, and renal and hepatic function tests. Fasting blood samples were also obtained to evaluate fasting blood sugar levels and the lipid profile.

Diabetes mellitus was defined according to the American Diabetes Association guidelines, which specify a fasting plasma glucose level of ≥ 126 mg/dL, a postprandial glucose level of ≥ 200 mg/dL, and/or HbA1c levels of 6.5% or higher. Patients who were already on an antidiabetic regimen or newly diagnosed at the time of admission were also classified as having diabetes mellitus.

Blood pressure was measured, and hypertension was defined according to the JNC 8 criteria, which specify a systolic blood pressure of ≥ 140 mmHg or a diastolic blood pressure of ≥ 90 mmHg. Patients who were already on antihypertensive therapy were classified as hypertensive.

Body mass index (BMI) was classified based on the patient's height and weight as follows: underweight (< 18.5 kg/m²), normal weight (18.5 - 24.9 kg/m²), pre-obese (25 - 29.9 kg/m²), and obese (≥ 30 kg/m²).

A family history was considered positive if the participant's mother, father, sister, or brother had experienced a heart attack or angina before the age of 60.

Dyslipidemia was defined according to the National Cholesterol Education Program (NCEP) Adult Treatment Panel-3 (ATP-3) guidelines. As per these guidelines, dyslipidemia is characterized by one or more of the following: total cholesterol ≥ 200 mg/dL, LDL cholesterol ≥ 130 mg/dL, HDL cholesterol < 40 mg/dL, non-HDL cholesterol ≥ 160 mg/dL, VLDL cholesterol ≥ 25 mg/dL, and/or triglycerides ≥ 150 mg/dL.

Based on the data collected from individual patients, the prevalence of risk factors and 10-year cardiovascular risk assessment were conducted using the QRISK2 calculator, available at https://www.qrisk.org/. Participants were categorized into low (<10%), moderate (10-20%), and high (>20%) risk groups according to the results obtained.
The current use of medications was recorded from the patients' prescriptions. To educate patients about their risk of developing cardiovascular disease, patient information leaflets in both the local language and English were provided. All cases were reviewed for potential drug-drug interactions using the Micromedex drug database, which classifies interactions as major, moderate, or minor, based on their severity.
Patients were enrolled as per the inclusion and exclusion criteria.

Inclusion criteria:

- All inpatients from the General Medicine and Cardiology departments diagnosed with dyslipidemia and/or diabetes.
- Patients of either sex.
- Patients aged 40-70 years.

Exclusion criteria:

- Patients with pre-existing atherosclerotic cardiovascular diseases, including stroke, myocardial infarction, transient ischemic attack, or angina.
- Patients with incomplete or insufficient data in their records.
- Patients unwilling to participate in the study.

Statistical analysis:

Data analysis was performed using GraphPad Prism and MedCalc statistical software, with a significance level set at $P < 0.05$. Descriptive statistics were applied to continuous data, and results were expressed as mean ± standard deviation (SD). Comparisons between means were conducted using a two-sample t-test, and a 95% confidence interval (CI) for the differences was calculated. The 'N-1' Chi-squared test was used to compare percentages.

RESULTS:

The study included a total of 100 patients, comprising 52 males and 48 females. Traditional risk factors and the general characteristics of the study population are presented in Table 1 and Table 2, respectively.

Table 1: Traditional Risk factors of study population

Parameters	**Category**	**Percentage**
Age (years)	40-55	35%
	56-60	26%
	61-70	39%
BMI (kg/m^2)	Under-weight	3%
	Normal	23%
	Pre-obese	52%
	Obese	22%
Blood pressure (mg/dl)	Normal	38%
	Pre-hypertension	28%
	Hypertension	34%
Smoking history	Non-smoker	65%
	Ex-smoker	12%
	Current smoker	23%

n=100. Where, n is the total number of participants involved in the study

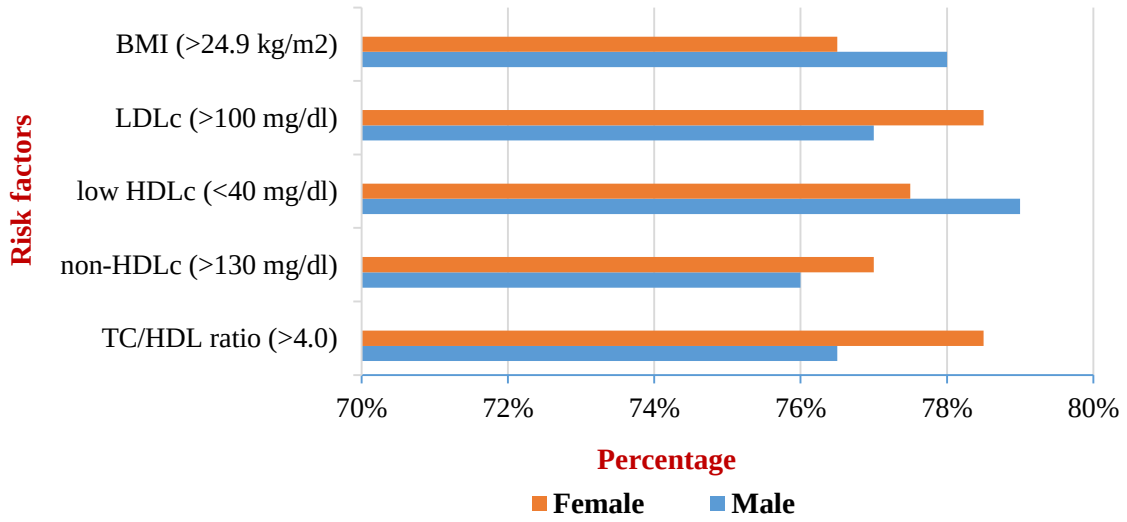
Table 2: General characteristics of patients in descriptive values

Characteristics	**Mean ± SD**		**Difference (95% CI)**	***P***
	Males (n=52)	**Females (n=48)**		
Age (years)	58.08 ± 7.25	56.87 ± 6.82	–4.00 - 1.58	0.39
BMI (kg/m^2)	26.36 ± 3.52	25.69 ± 3.84	–2.13 - 0.79	0.36
Fasting blood sugar (mg/dl)	166.79 ± 12.84	165.08 ± 10.61	–6.40 - 2.98	0.47
HDLc (mg/dl)	39.54 ± 7.10	38.70 ± 6.48	–2.54 - 2.86	0.90
LDLc (mg/dl)	118.20 ± 8.24	125.34 ± 7.16	4.06 - 10.21	< 0.0001
Non-HDLc (mg/dl)	142.96 ± 7.65	149.43 ± 7.24	3.50 - 9.43	< 0.0001
TC/HDLc ratio	4.241 ± 0.245	4.524 ± 0.142	0.20 - 0.36	< 0.0001

The mean age of male patients was 58.08 ± 7.25 years, while for females, it was 56.87 ± 6.82 years. Among the traditional risk factors, 23% of patients were smokers, 38% had a positive family history of cardiovascular disease (CVD), and 34% had hypertension. Most patients were classified as pre-obese, with an average BMI of 26.36 ± 3.52 kg/m² for males and 25.69 ± 3.84 kg/m² for females. Fasting blood sugar levels were higher in males compared to females, with mean ± SD values of 166.79 ± 12.84 mg/dL for males and 165.08 ± 10.61 mg/dL for females.

Various risk factors, including body mass index (BMI), LDL cholesterol (LDLc), HDL cholesterol (HDLc), non-HDL cholesterol (non-HDLc), and the TC/HDL ratio, are presented as percentages in Figure 1. Among these, elevated TC/HDL ratios and LDLc levels were the predominant risk factors in women, while high BMI and low HDLc levels were the major risk factors in men.

Figure 1: Risk factors in percentage



The mean ± SD values for HDL cholesterol (HDLc) were 39.54 ± 7.10 in males and 38.70 ± 6.48 in females. For LDL cholesterol (LDLc), the values were 118.20 ± 8.24 in males and 125.34 ± 7.16 in females ($P < 0.0001$). Non-HDL cholesterol (non-HDLc) levels were 142.96 ± 7.65 in males and 149.43 ± 7.24 in females. A notable prevalence of low HDLc and elevated triglyceride levels was observed. The mean ± SD TC/HDL ratio was 4.241 ± 0.245 in males and 4.524 ± 0.142 in females ($P < 0.0001$). The mean serum VLDL cholesterol (VLDLc) level was 32.64 mg/dL.

Table 3 describes the percentage of males and females in high, medium and low risk category of cardiovascular disease. Based on the QRISK2 score obtained, 69.2% of men and 70.8% of women are at high risk of getting CVD in future. The moderate risk was found to be 21.1% and 25.1% in men and women, respectively.

Table 3: Distribution of patients in different QRISK2 category

Total patients (n=100)	**QRISK2 score**		***P***
	Males (%) (n=52)	**Females (%) (n=48)**	
High risk	69.2	70.8	0.865
Moderate risk	21.1	25.1	0.636
Low risk	9.61	4.1	0.281

A total of 19 drug-drug interactions were identified, categorized by severity as major, moderate, or minor. Of these, 47.36% of the prescriptions involved major severity interactions. The major drug-drug interactions are detailed in Table 4.

Table 4: Major drug-drug interactions. (n=100)

DRUGS	INTERACTING EFFECT	MANAGEMENT
Clopidogrel + Aspirin	Concomitant use of aspirin with a platelet aggregation inhibitor like clopidogrel may increase the risk of bleeding	Monitor signs of bleeding and avoid OTC salicylate products.
Aspirin + Furosemide	Concurrent use of NSAIDs and loop diuretics may increase the risk of nephrotoxicity.	Monitor the signs of worsening renal function and assure diuretic efficacy.
Amiodarone + Digoxin	Serum digoxin concentration is increased due to displacement of digoxin from protein binding sites.	Need for digoxin is evaluated. Serum digoxin levels are closely monitored and patients should be observed for clinical toxicity.
Metolazone + Torsemide	The risk of electrolyte and fluid imbalance is increased.	Monitor electrolyte levels, blood pressure and renal function regularly.
Warfarin + Amiodarone	Combination of these medications may lead to hypoprothrombinemia and bleeding.	Dosage reduction of warfarin is recommended. Monitor prothrombin time and INR.
Metoprolol + Clonidine	Increased risk of sinus bradycardia	Monitor heart rate and blood pressure when both drugs are given concurrently.
Amlodipine + Clopidogrel	Decreased anti-platelet effect of clopidogrel and increased risk of thrombotic events.	Monitor closely for the occurrence of bleeding complications.
Digoxin + Naproxen	Naproxen may increase the plasma levels of digoxin.	Dosage adjustment of digoxin is considered.
Fenofibrate + Atorvastatin	The risk of myopathy or rhabdomyolysis is increased.	Patients should be advised to report unexplained muscle pain, fatigue, fever and dark coloured urine.
Glipizide + Aspirin	Combined use of these medications increase the risk of hypoglycemia.	Dosage adjustment of glipizide is recommended.

DISCUSSION:

Recent studies indicate that due to heterogeneity, the risk of coronary artery disease (CAD) is not evenly distributed among patients, making risk stratification essential for tailoring treatment. Risk stratification not only facilitates effective disease management but also ensures low-cost, resource-efficient care. Additionally, patients' awareness of their anticipated risks can improve their health behaviors and compliance with interventions.[8]

In our study, cardiovascular disease (CVD) risk stratification was performed in 100 patients with dyslipidemia and diabetes. The majority of patients were in the 61-70 year age group. Margaret McDonald et al.[9] noted in their study that adults aged 65 and older are particularly affected by dyslipidemia, diabetes, and hypertension, which are well-established risk factors for CVD. This increased susceptibility may be attributed to age-related changes in the heart and blood vessels, which can impair the normal functioning of the cardiovascular system.

An increase in Body Mass Index (BMI) is directly associated with a higher risk of developing cardiovascular disease (CVD), with significant implications for morbidity and mortality. In our study, 52% of patients were classified as pre-obese, and 22% as obese. These groups are more vulnerable to CVD compared to individuals with a normal BMI. Similar findings were reported by Ortega et al. [10] and Mokta et al. [11], who also observed a higher incidence of elevated BMI in their study populations.

A positive family history of cardiovascular disease (CVD) was recorded in 38% of patients. As an independent predictor of CVD, assessing family history can help identify high-risk individuals, allowing for a targeted approach to risk reduction. Family history evaluation is also a valuable tool for identifying prevalent CVD cases and promoting population-wide disease prevention. [12]

The prevalence of smoking in our study was found to be 23%, indicating that the majority of patients were non-smokers. The relatively low smoking prevalence may be attributed to patients' hesitancy in disclosing their actual smoking history.

Approximately 34% of patients were classified as hypertensive, and 28% were in the pre-hypertensive category. Hypertension and diabetes often co-exist in patients. A study by Sowers et al. [13] suggests that hypertension is twice as common in individuals with diabetes compared to those without. The study also highlighted that up to 75% of cardiovascular disease (CVD) cases in diabetic patients may be attributable to hypertension.

In women, the primary risk factors identified were the TC/HDLc ratio and LDL cholesterol (LDLc). A study by Minmin Wang et al. [14] also reported that LDLc levels were higher in women than in men. Although dyslipidemia is more prevalent in females, the incidence of low HDL cholesterol (HDLc) levels was found to be higher in men compared to women.

In our study, the most prevalent lipid abnormality was low HDL cholesterol (HDLc) levels, followed by high LDL cholesterol (LDLc) and non-HDL cholesterol (non-HDLc) levels. These abnormalities were more pronounced in female patients than in male patients. Vicky Moor et al. [15] also identified low HDLc levels and high LDLc levels as the most common lipid abnormalities. He further noted that low HDLc levels were found to be equally prevalent alongside elevated LDLc levels, both of which are common risk factors for cardiovascular disease (CVD). The ICMR INDIAB study, published by Shashank Joshi et al. [16], also reported that 44.9% of the study population had low HDLc as the sole lipid abnormality.

The TC/HDLc ratio is a strong predictor of cardiovascular disease (CVD) and is essential for calculating the QRISK2 score. In our study, approximately 78% of women and 76% of men had a TC/HDLc ratio greater than 4.

Risk stratification was performed using the QRISK2 calculator. QRISK2 has shown strong performance in Indian populations, demonstrating better calibration properties and providing consistent and accurate estimates for identifying high-risk individuals.

CONCLUSION:

The rising prevalence of cardiovascular disease (CVD) poses a significant public health challenge. To effectively manage and control CVD, implementing risk stratification strategies for primary prevention could be crucial. This approach may enhance patient adherence to treatment and encourage the adoption of healthy lifestyle changes. Risk estimation also assists clinicians in selecting appropriate therapeutic and preventive interventions. However, larger-scale, multicenter, population-based studies are needed to tailor cardiovascular risk assessments more effectively. Additionally, improved communication among healthcare providers can help reduce the incidence of drug interactions, ultimately ensuring better patient care.

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