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Assessment of Cardiovascular Risk Factors in Rheumatoid Arthritis Patients Using Framingham Risk Score

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Abstract **Original Research Article**

Background: Chronic autoimmune rheumatoid arthritis generates harm to body systems beyond joints since it increases patients' vulnerability to developing cardiovascular disease. There are no studied reports examining how to evaluate cardiovascular risks for RA patients in Bangladesh. ***Objectives:*** The purpose of this study is to determine the cardiovascular risk factors among RA patients by applying the Framingham Risk Score (FRS) to identify principal risk predictors. ***Methodology:*** A two-year cross-sectional study took place at BIRDEM General Hospital between July 2022 and June 2024. A risk score analysis according to the Framingham model required data from eight criteria, including the patient's age, together with cholesterol measurements and blood pressure readings and smoking status, and presence of diabetes. According to Framingham Risk Score classification, patients were divided into low risk (<10%) and intermediate risk (10–20%), and high risk (>20%). SPSS version 25.0 was used for statistical analysis under a $p<0.05$ significance level. ***Result:*** The research included 100 RA patients with 78% females and 22% males, who fulfilled specified enrollment requirements. Analysis revealed that FRS assessment categories divided the study participants as 41% low risk while 36% had intermediate risk and 23% displayed high risk levels. This study established diabetes mellitus ($p<0.001$), dyslipidemia ($p=0.001$), hypertension ($p=0.003$), increasing age ($p<0.001$), and elevated C-reactive protein (CRP) levels ($p=0.002$) as major risk factors that increased FRS. The participants with RA that exceeded 10 years of existence demonstrated an increased cardiovascular risk profile, but this correlation did not meet statistical significance ($p=0.009$). Research findings supported earlier studies which showed that RA affects females at a ratio of 3.5 to 1 than males. ***Conclusion:*** The study demonstrates that patients with RA exhibit a substantial rise in their CVD risk, and diabetes, dyslipidemia, and hypertension serve as major causal elements. These findings underline the need for RA patients to receive regular cardiovascular screening as well as comprehensive preventive measures, including lifestyle improvements and proper healthcare management protocols.

Keywords: Cardiovascular risk, Rheumatoid Arthritis Framingham Risk Score.

INTRODUCTION

Rheumatoid Arthritis (RA) is a chronic systemic autoimmune disease that initially causes joint inflammation, pain, swelling, and stiffness but damages other tissues and organs, including the heart, kidneys, lungs, digestive system, eyes, skin, and nervous system, after a certain period [1-3]. According to the WHO, 18 million people are suffering from RA worldwide as of 2019 [4]. With widespread inflammation, RA generates systemic complications [5]. Researchers suggested that rheumatoid arthritis increased the risk of cardiovascular disease 1.5-2 folds [6]. Hypertension, diabetes, obesity, smoking, and an unhealthy lifestyle increase cardiovascular risks, along with rheumatoid arthritis [7]. The concept of Framingham Risk Score (FRS) was first developed in 1948 by Framingham Heart Study by a long-term epidemiological study [8]. It is a calculation tool that predicts an individual's risk of developing cardiovascular disease by analyzing related risk factors like age, sex, cholesterol levels, blood pressure, smoking status, and diabetes [9]. According to previous research, 4.5% of Bangladeshi patients suffer from cardiovascular disease [10]. The prevalence of rheumatoid arthritis

among cardiovascular patients is unexplored in Bangladeshi settings. This study aims to determine the cardiovascular risk factors among rheumatoid arthritis patients by using the Framingham Risk Score.

METHODOLOGY

A bi-year cross-sectional study was conducted in the Department of Internal Medicine, BIRDEM General Hospital, in the timeline of July 2022 to June 2024. Framingham Risk Score was calculated based on the Age (years), Total Cholesterol (mg/dL), HDL Cholesterol (mg/dL), Systolic Blood Pressure (SBP) (mmHg), Hypertension Treatment (Yes/No), Smoking Status (Current/Former/Never), Diabetes Status (Yes/No) of patients and the interpretation was given as Low Risk (<10%), Intermediate Risk (10–20%) and High Risk (>20%) [11]. Patients' data were collected by following the declaration of Helsinki and some study-specific inclusion and exclusion criteria.

Inclusion criteria

- Patient age ≥18 years.
- Confirmed diagnosis of Rheumatoid arthritis by blood tests: Rheumatoid Factor (RF) and Anti-CCP Antibody.
- Willingness to provide written informed consent.

Exclusion criteria

- Pre-existing cardiovascular disorder.
- Known or self-claimed pregnancy.
- Chronic kidney disease.
- Severe hepatic impairment.

The researcher collected data by using individual case report forms (CRFs) and after a successful data collection, all data were analyzed by MS Excel and SPSS version 25.0. A p-value<0.05 was considered significant in a 95% confidence interval.

RESULT

The study enrolled a sum of 100 patients, including 78 females and 22 males. The female-to-male ratio calculated for this study is 3.5:1.

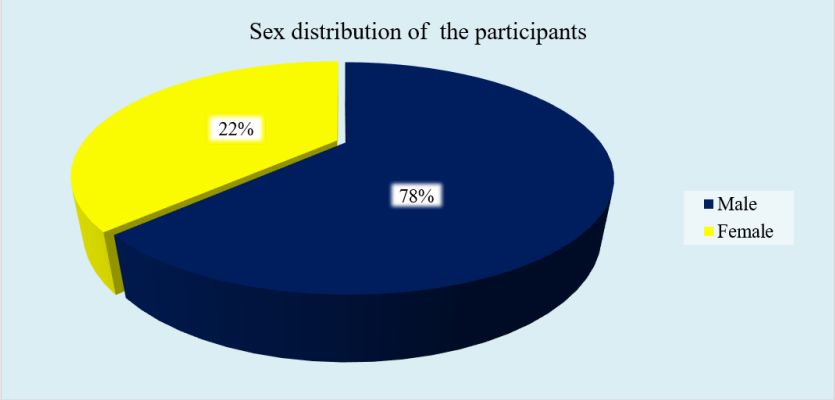

Figure 1: Pie chart showed demographic distribution of patients, sex (N=100)

Figure 01 shows the prevalence of female participants over male participants in this study. The female to male ratio proves that females are at three times more risk than male patients.

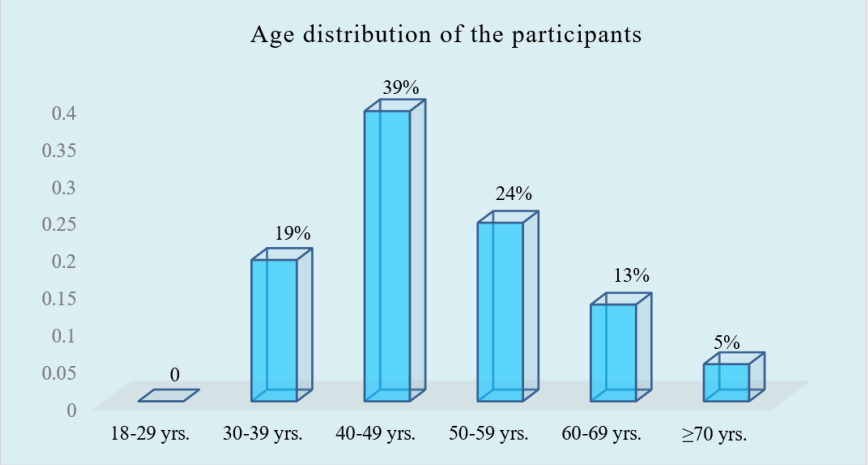

Figure 2: Column chart showed demographic distribution of patients, age (N=100)

Figure 02 portrays that the majority of the patients diagnosed with rheumatoid arthritis are between the ages of 40-49 years. The mean age determined by analysis was 45.8 ± 11.6 years, with an upper age limit of 71 years and lower limit of 33 years.

Table I: Clinical Characteristics of patients with rheumatoid arthritis (N=100)

Variable	RA Patients (n=100)
Hypertension, n (%)	42 (42.0%)
Diabetes Mellitus, n (%)	20 (20.0%)
Dyslipidemia, n (%)	48 (48.0%)
Smoking Status, n (%)	
- Current Smoker	15 (15.0%)
- Former Smoker	18 (18.0%)
- Never Smoked	67 (67.0%)
BMI (kg/m²), mean ± SD	27.3 ± 4.0
Family History of CVD, n (%)	28 (28.0%)

Table I showcases the clinical profile of study subjects that describes that 42% of patients have existing hypertension, 20% diabetes mellitus, and 48% Dyslipidemia. The percentage of former and current smoker patients is 33%. The mean BMI calculated 27.3 ± 4.0 kg/m², which indicates overweight characteristics, and a total 28% of study subjects were found with a family history of cardiovascular diseases.

Table II: Distribution of patients by Framingham Risk Score (N=100)

Risk Category	Number of Patients (n)	Percentage (%)
Low Risk (<10%)	41	41.0%
Intermediate Risk (10–20%)	36	36.0%
High Risk (>20%)	23	23.0%

Table II categorizes patients by Framingham Risk Score, which indicated that 23% of patients are at high risk of CVD, 41% are at low risk, and 36% are at intermediate risk.

Table III: Key predictors of increase FRS among RA patients (N=100)

Variable	FRS Increase (%)	p-value
Diabetes Mellitus (DM)	+9.2	<0.001*
Dyslipidemia	+7.5	0.001*
Hypertension	+6.3	0.003*
RA >10 years	+5.1	0.009
Age (per decade)	+4.8	<0.001*
Elevated CRP	+3.9	0.002*

Table III draws a relationship between clinical factors and FRS among rheumatoid arthritis patients. Data shows that diabetes mellitus significantly increased FRS (P<0.001). Dyslipidemia, Hypertension, Aging, and elevated CRP also contributed to increased risk of CVD (P<0.05). Rheumatoid arthritis duration of more than 10 years is not clinically significant to the association of increase Framingham Risk Score.

DISCUSSION

Framingham Risk Score (FRS) uses a specific algorithm to calculate and predict cardiovascular risk factors in patients. In North America, this calculation is measured as a validated predictor for CVD risk [12]. In Bangladesh, previous studies have been carried out to predict CVD risk in diabetic patients [13]. This study assessed cardiovascular risk factors among rheumatoid arthritis patients by using Framingham Risk Scoring. A combined 100 subjects with RA were included in this study, where the female-male ratio was 3.5:1. A study on rheumatoid arthritis shows the female/male ratio to be 3:1 in rheumatoid arthritis which is similar to recent findings [14]. Kvien T K *et al.*, 2006 published that females are more prone to rheumatoid arthritis than males, and he also added the rate incidence is 4-5 times higher below the age of 50 [15]. The current study resulted in the mean age of patients being 45.8 ± 11.6 with a range of 33-71 years, where the majority of the cases were detected in the age of 40-49 years. An Egyptian cohort study on rheumatoid arthritis calculated the mean age for male subjects to be 44.9± 10.2 years and for female patients 49.9± 13.2 years; 83.1% of their study subjects were female, and 16.2% were male [16]. This study and the previous studies suggest that women after 30 years of age are at more risk of rheumatoid arthritis. Due to increase hormonal fluctuation [17], especially estrogen influence [18], genetic (X-linked) factors [19], and microchimerism [20], RA is more common in females than males. The clinical profile of RA patients reveals that 42% of patients are suffering

from hypertension, 20% diabetes mellitus, and 48% dyslipidemia. Earlier research demonstrated that hypertension is 32.35% common in patients with rheumatoid arthritis [21]; DM incidents rates in patients with RA is 5.2% to 16.7% according to studies [22]; Prevalence of dyslipidemia is 56.5% in rheumatoid arthritis patient [23]. Dyslipidemia refers to a condition of abnormal rising of lipid levels in blood [24]. Guimarães M F B R *et al.*, 2019 disclose the tends to grow obesity in RA patients and the mean BMI calculated by their study was 27.1 ± 4.9 kg/m² [25] which is similar findings to this study (27.3 ± 4.0 kg/m²). Considering related factors, this study predicted that 41% of patients are at low risk of cardiovascular disease, 36% of patients are at intermediate risk, and 23% of patients are at high risk of CVD. Islam A M *et al.*, 2016 found that the rate of rheumatoid heart disease and stroke in Bangladesh is 20-25% [26], which is agreeable to the study findings. The p-value<0.001 suggests that DM in RA patients exerts a potential risk to develop cardiovascular disorder. Previous research also suggested DM tends to obesity, insulin resistance, and uncontrolled hyperglycemia, which increase the risks of cardiovascular disease [27]. More preventive care for patients with DM and RA should be taken to lower the risk of CVD [28]. Dyslipidemia and Hypertension are some other significant factors ($p<0.05$) to increase Framingham Risk Score to develop CVD by the study findings. Lifestyle modification and opting for a healthy diet with low sodium is advisable to control dyslipidemia and hypertension in RA patients [29]. The risk of CVD significantly rises ($p<0.05$) with increasing age, and elevated CRP indicates inflammation in body, which is also related to developing CVD ($p<0.05$) in rheumatoid arthritis patients. Regular exercise, weight loss, and dietary control can decrease inflammation, as well as C-reactive protein, and lower the risk of cardiovascular disease [30].

LIMITATION

The single-center study with a limited population does not generalize the overall rheumatoid arthritis patients in Bangladesh. A details research with long-term follow-up will provide the fact-based outcome of Framingham Risk Score to predict the development of cardiovascular disease in rheumatoid arthritis patients at Bangladeshi settings.

CONCLUSION

The research demonstrates that higher cardiovascular risk exists for RA patients due to the presence of diabetes along with dyslipidemia and hypertension. The Framingham Risk Score effectively categorized cardiovascular disease risk for this study group. Regular screening in combination with early intervention through proper medical care as well as lifestyle changes, must become essential practices to help RA patients with their significant cardiovascular risks.

Author Contribution

Conceptualization, Methodology, Formal analysis, Investigation, Data collection, analysis, and original draft by RC.

MSH, MTI, MRR, SY, SKM, and RSCS participated in writing, reviewing and editing, and visualizing.

Conceptualization, Methodology, Formal analysis, Investigation, Data collection, analysis, and original draft by Chakraborty R.

Haque MS, Islam MT, Rahman MR, Yesmin S, Mazumder SK, Sarker RSC participated in writing, reviewing and editing, and visualizing.

Abbreviations

RA: Rheumatoid Arthritis
FRS: Framingham Risk Score
CVD: Cardiovascular Disease
DM: Diabetes Mellitus
HDL: High-density lipoprotein
SBP: Systolic Blood Pressure
CRP: C-reactive Protein
BMI: Body Mass Index
CRFs: Case Report Forms
WHO: World Health Organization

Conflicts of Interest: The authors declare no conflicts of interest.

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