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RESEARCH ARTICLE
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SIGNIFICANCE OF THE DUKE TREADMILL SCORE ON THE SEVERITY OF CORONARY ARTERY DISEASE IN PATIENTS WITH AND WITHOUT DIABETES

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ABSTRACT

Background and Aim: The coronary artery disease risk stratification can be done with established clinical tool Duke Treadmill Score (DTS). The present study aimed to investigate the role of Duke Treadmill Score in predicting the severity of coronary artery disease in diabetic vs. non-diabetics.

Patients and Methods: This prospective study was conducted on 100 diabetic and 100 non-diabetic patients in the Cardiology Department of Tertiary Care Hospital of Pakistan from January 2020 to December 2022. All the diabetic patients with blood sugar level >126 mg/dL were enrolled. Standard Bruce protocol was used for measuring the exercise stress tests. ST-T changes, rate, and rhythm were monitored by an electrocardiogram (ECG). Exercise test was terminated based on chest pain, ST depression N3 mm, ventricular tachycardia, excessive increase (>230 mm Hg), and limiting symptoms (such as dyspnea and dizziness). Data analysis was done using SPSS version 27.

Results: The overall mean age of diabetic and non-diabetic was 58±9.6 years and 58±9.7 years respectively. There were 112 (56%) male and 88 (44%) female. Hypertension, current smoking, and Hypercholesterolemia were different risk factors found (64% vs. 44%), (15% vs. 20%), and (21% vs 26%) respectively. Survival free from congestive heart failure, cardiac death, and nonfatal myocardial infarction was 15%, 87%, and 52% respectively in low to high-risk diabetic patients and 19%, 90%, and 55% respectively in nondiabetics. Coronary angiography and secondary events were more in diabetic groups than non-diabetic during follow-up. The severity of coronary artery disease was assessed using DTS in both diabetics and non-diabetics.

Conclusion: The DTS alone is an effective method for detecting a significant coronary artery. The DTS is an accurate predictor of CAD. Based on clinical data, individuals should be treated for DTS group intermediate risk outcome using exercise tests.

Keywords: Coronary artery disease, Duke Treadmill score, Diabetic patients

INTRODUCTION

The most significant risk factor for coronary artery disease (CAD) is diabetes with increasing prevalence in men and women [1, 2]. The primary cause of mortality among diabetic patients is the coronary heart disease that approximately affects 25% myocardial infarction survivors [2, 3]. With MI prior history, non-diabetic had similar risk of CAD as diabetic with no MI. Diabetic patients have a substantially worse chance of surviving after a MI [4]. The prevalence of diabetic patients is increasing with the majority of cases being subjected to exercise testing for diagnosis and risk classification of CAD. Numerous studies have been carried out for prognostic and diagnostic utility of exercise testing [5]. The American College of Cardiology/American Heart Association has approved the Duke Treadmill Score (DTS) for stratification of cardiac risk [6]. When compared to nondiabetics, diabetics have reduced exercise tolerance, are frequently obese, have autonomic instability, and peripheral vascular disease.

Coronary artery disease (CAD) is now the leading cause of mortality worldwide. CAD is responsible for almost half of all fatalities, as a result, it is critical to identify CAD patients with [7, 8]. Despite the advancement in imaging technology, the diagnosis, location, and CAD severity could be measured by coronary angiography as a gold standard [9]. The treadmill score showed significant reliability in CAD patient's prognosis [10]. The DTS is previously used as a predicting tool, recently used as a diagnostic tool and actually proved to diagnose CAD better than ST segmentation [11]. The present study aimed to determine the role of DTS in predicting severity of CAD in diabetic vs non-diabetic patients.

METHODOLOGY

This prospective study was conducted on 100 diabetic and 100 non-diabetic patients in the Cardiology Department of Tertiary Care Hospital of Pakistan from January 2020 to December 2022. All the diabetic patients with blood sugar level >126 mg/dL were enrolled. Standard Bruce protocol was used for measuring the exercise stress tests. ST-T changes, rate, and rhythm were monitored by an electrocardiogram (ECG). Exercise test was terminated based on chest pain, ST depression N3 mm, ventricular tachycardia, excessive increase (>230 mm Hg), and limiting symptoms (such as dyspnea and dizziness). All the patients with congestive heart failure (CHF), known CHD, previously undergone revascularization, and had a permanent pacemaker were excluded. Based on Treadmill score and Duke Classification, patients were divided into risk categories. Patients with a treadmill score of ≥5 were categorized as low risk, those with a score of -10 to 4 as intermediate risk, and those with a treadmill score of <-10 as high risk. ECG abnormalities, Chest pain, and high serum marker were used to diagnose myocardial infarction. In DTS, various exercise parameters such as peak heart rate, peak systolic BP, peak diastolic BP, and exercise duration were noted.

Descriptive statistics were done using SPSS version 27. Numerical variables such as age, BMI, and exercise parameters were measured and described as mean ± SD whereas qualitative variables gender, risk factors, and DTS predicting severity were expressed as frequency and percentage. Chi-square or Fisher exact test was used for comparing the coronary artery disease parameters in diabetic vs non-diabetic.

RESULTS

The overall mean age of diabetic and non-diabetic was 58±9.6 years and 58±9.7 years respectively. There were 112 (56%) male and 88 (44%) female. Hypertension, current smoking, and Hypercholesterolemia were different risk factors found (64% vs. 44%), (15% vs. 20%), and (21% vs

26%) respectively. Survival free from congestive heart failure, cardiac death, and nonfatal myocardial infarction was 15%, 87%, and 52% respectively in low to high-risk diabetic patients and 19%, 90%, and 55% respectively in nondiabetics. Coronary angiography and secondary events were more in diabetic groups than non-diabetic during follow-up. The severity of coronary artery disease was assessed using DTS in both diabetics and non-diabetics. The incidence of coronary angiography was (85% vs. 69%, P=0.029). Intermediate risk was found in significant number of diabetic patients with prevalence of late revascularizations (33% vs 14%, P = .021) and coronary angiography (84% vs 68%, P = .029) compared to non-diabetic patients. Baseline characteristics of diabetic and non-diabetic patients are shown in Table-I. Indications for exercise tests in diabetic vs. non-diabetic are depicted in Figure-1. Exercise parameters are shown in Table-II. Association of diabetes with subsequent events are shown in Table-III.

Table-I baseline characteristics of patients

Variables	Diabetic (N=100)	Non-Diabetic (N=100)	P-value
Age (years)	58±9.6	58±9.7	0.552
Gender N (%)			0.759
Male	53 (56%)	59 (59%)	
Female	47 (44%)	41 (41%)	
Risk factors N (%)			
Hypertension	64%	44%	<0.001
Current smoker	20%	20%	0.199
Hypercholesterolemia	21%	26%	0.990

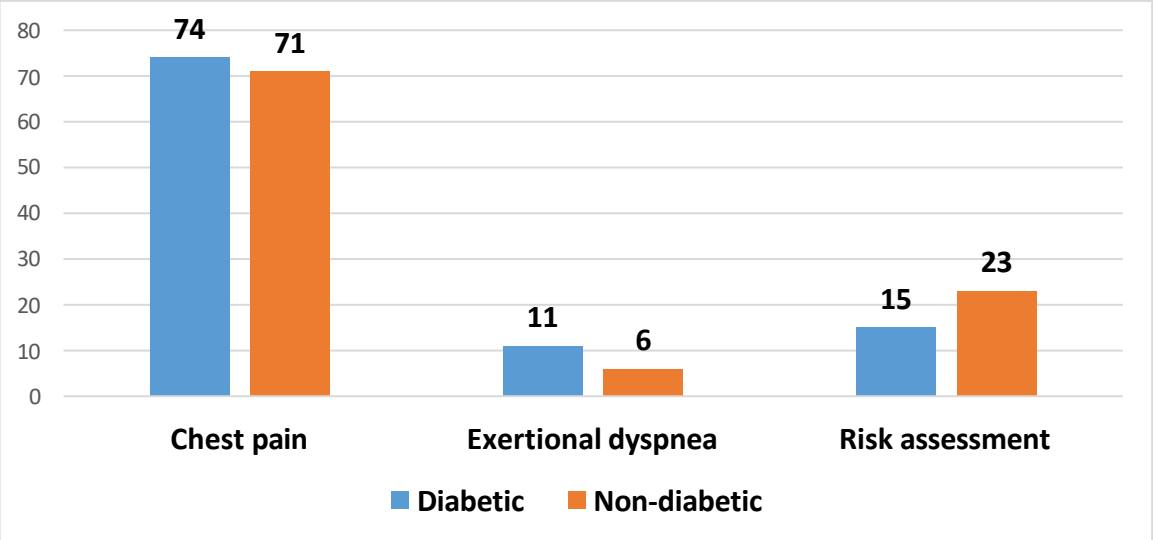

Figure-1 Indications for exercise tests in diabetic vs. non-diabetic

Table-II DTS and exercise parameters for both diabetic and non-diabetic

Variables	Diabetic (N=100)	Non-Diabetic (N=100)	P-value
DTS severity N (%)			0.552
Low risk	39 (39%)	56 (56%)	
Intermediate	46 (46%)	33 (33%)	
High risk	15 (15%)	11 (11%)	
Exercise parameters			
Peak heart rate (beat/mint)	143.9 ±16.4	146.9 ±18.4	0.019
Peak systolic BP (mm Hg)	180.8 ± 24.6	172.8 ± 24.9	0.003
Peak diastolic BP (mm Hg)	83.9 ± 10.8	83.0 ± 11.8	0.638
Exercise duration (minutes)	5.7 ± 2.5	7.4 ± 2.8	<0.001

Table-III Association of diabetes with subsequent events

Outcomes	Diabetic (N=100)	Non-diabetic (N=100)	P-value
Primary (MACE)	9 (9%)	4 (4%)	0.084
Secondary (CHF)	33 (33%)	14 (14%)	0.021
Coronary angiography	84 (84%)	68 (68%)	0.029

DISCUSSION

The present study mainly investigated the role of DTS in predicting severity of coronary artery disease in diabetic vs. non-diabetic and found that DTS alone is an effective method for detecting a significant coronary artery. The DTS is an accurate predictor of CAD. The intermediate-risk group accounts for a considerable number of individuals who fall between these two groups, and therapeutic treatment of this group is less obvious. Our findings support the DTS's therapeutic use in risk stratification for CAD and found a significant variation in outcomes across the risk categories indicated by the DTS and early or late revascularization in diabetic and non-diabetic patients. Regarding exercise testing, diabetic patients are obese and had different types of population and had a higher prevalence of complications such as peripheral neuropathy, calcium channel blockers, decreased functional capacity, HTN, increased heart rate, and physical deconditioning. These variables have an adverse impact on diabetes patients' capacity to attain a low-risk DTS. Despite the existence of severe CAD, which is more common in diabetic patients, the exercise capability that may not reach to generate ischemia, ECG abnormalities and symptoms. As a result, a large proportion of diabetes individuals may be classed as intermediate-risk.

The inpatient group had established the Duke Treadmill Scoring system from a retrospectively analyzed and subsequently prospectively validated patients [12-14]. The scoring method combined all of the treadmill test's independent prognostic information into a simple quantitative calculation.

Zaman et al [15] reported that women showed better performance in DTS than males in terms of avoiding CAD, a significant CAD in low risk women, and left main stenosis like severe disease. Numerous studies have been conducted to investigate the exercise treadmill testing predictive utility in diabetic patients, but no data have been collected particularly employing the DTS for risk classification [16-20].

A thorough clinical history and physical examination can give valuable prognostic information [21]. Prior MI, symptoms and indications of heart failure [22], and the pattern of incidence (recent onset or progressive) and severity of angina, particularly if refractory to treatment [23-25], are also relevant considerations.

CONCLUSION

The DTS alone is an effective method for detecting a significant coronary artery. The DTS is an accurate predictor of CAD. Based on clinical data, individuals should be treated for DTS group intermediate risk outcome using exercise tests.

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