Predicting Risk of Incident Heart Failure Among Type 2 Diabetic Patients Using the WATCH-DM Risk Score

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Abstracts: Background: The concomitant occurrence of type 2 diabetes mellitus and heart failure is common with increased mortality. WATCH-DM risk score is newly developed that assists heart failure prediction in the future five years. **Objective:** To predict the risk of heart failure among patients with type 2 diabetes mellitus in outpatient setting, using the novel WATC DM risk score. **Methodology:** Descriptive cross sectional study was applied involving a convenient sample of diabetic patients in single diabetic center in Baghdad over period of 1 year, where each one interviewed and asked about sociodemographic data, previous myocardial infarction and coronary artery bypass graft then Blood pressure measured, (electrocardiography)ECG performed and the patient send for investigations need for WACH-DM risk scoring including fasting blood sugar, Serum Creatinine and HDL-C, risk score calculated for each patient according to the WACH–DM score. **Results:** The sample included 112 diabetic patients of who 81 (75%) of them were females, mean WATCH-DM score was 10.39±3.6 (mean± SD), very low score 26%, high score 24% and very high score 19%. **Conclusion:** Among study sample 43% of patients have high and very high risk score of incident heart failure using WATCH-DM risk score.

Keywords: Heart Failure, Prediction, Diabetes, Risk Score, Incidence.

1. INTRODUCTION

The incidence of type 2 diabetes mellitus has been showing an alarming increase in which it was registered among 382 individuals globally during 2013, and thus expected to reach 592 by 2035. [1]

Countries of low and middle income had witnessed also increasing numbers of diabetic cases in the last 30 years, among them the MENA region with a 9.2% prevalence from 2017 and expected to show a 110% through 2045. [2,3].

Iraq as a MENA region country has exhibited diabetes mellitus type 2 prevalence range 8.5-13.9% and thus a high mortality rate occurring in 51.8% in below 60 years' diabetic patients. [3,4].

The risk of heart failure in diabetic patients is twice in comparison to non-diabetics, and especially among female in comparison to males showing in 5folds decreasing to 2 folds respectively, such sex effect could not be explained. [5-8].

The risk of heart failure among diabetes have been long identified through the past 40 years and the tern of diabetic cardiomyopathy was developed in the absence of cofactors as increased cholesterol blood level and increased blood pressure heart failure can still develop, this fact is supported by the recent study the reported a 44% of heart failure hospitalized patients were diabetics. [9,10].

HbA1c level has a U shaped association with heart failure mortality, since a level of 7.1% show a decreased mortality risk , while observational studies have documented an increased mortality with increased HbA1c levels, this reflects that good control of blood glucose level will improve the outcome, which lead to the development of a novel machine "the WATCH-DM score" that integrates eight variables that are the age, blood pressure, HbA1c, blood cholesterol, serum creatinine the T wave , QRS duration and history of myocardial infarction and then calculating the risk of heart failure among type 2 diabetics classifying them from very low r to very high five year

risk, The machine learning–based risk prediction model yielded favorable discrimination and greater accuracy compared with traditional risk scores, besides, this risk score benefits from not requiring specific cardiovascular biomarker or adjunctive imaging assessment. [11-14].

2. RATIONALE OF STUDY

The increasing prevalence of diabetes type 2 and future disabling morbidity and resulting mortality including heart failure future risk, besides the limited study number involving the application of this novel machine raise the need of such study in Iraq so as to spot light on WATCH-DM risk score.

Our study aim is

To assess the risk of heart failure among type 2 diabetic patients in outpatient setting, using the novel WATC DM risk score.

3. PATIENTS AND METHODS

A cross sectional study enrolled a convenient sample of patients with type 2 Diabetes in single diabetic center in Baghdad over period of 1 year, where each one was interviewed and asked about their age, past history of developing previous myocardial infarction and undergoing coronary artery bypass grafting(CABG) then the Blood pressure was measured, and resting chest echocardiogram ,ECG were performed then the patient was sent for investigations needed for WACH-DM risk scoring ,including: fasting blood sugar, S. Creatinine and HDL-C. after completing the needed examination and investigations, the risk score was calculated for each patient according to the WACH–DM score, then patients were classified as very low, low, average, high and very high risk.

4. EXCLUSION CRITERIA

Patients diagnosed heart failure reduced ejection fraction (HFrEF) with ejection fraction (EF) less than 50% were excluded from the study.

5. STATISTICAL ANALYSIS

Data entry was done via Excel, frequency, percentage, and range (minimum-maximum values) measures were used to present the data. the mean and standard deviation were used for continuous data, suitable charts and graphs were constructed.

6. ETHICAL CONSIDERATION

Verbal consent was taken from patients prior to the start of the study with full explanation about study aims and the subsequent test going to be performed.

RESULTS

Table (1): distribution of participants according to risk score(N112)

Risk of HF	Risk score	% of getting the risk of HF by WATCH	N (%)	
Very low	=<7	1.1	30	26
Low	8-9	3.6	24	21
Moderate	10	4.7	9	8
High	11-13	9.1	27	24
Very high	=>14	17.4	22	19
Total			112	100%
mean± SD 10.39±3.6				

Table 1 shows 30 (26 %)of the sample have a very low score (<7), and 21% have low score (8-9), 24% have high risk score (11-13), very high risk score (=>14) was registered among 19 % of the participants while only 8% of the participants have moderate score (10), mean WATCH-DM score was 10.39±3.6 (mean± SD) and the range is 4-19.
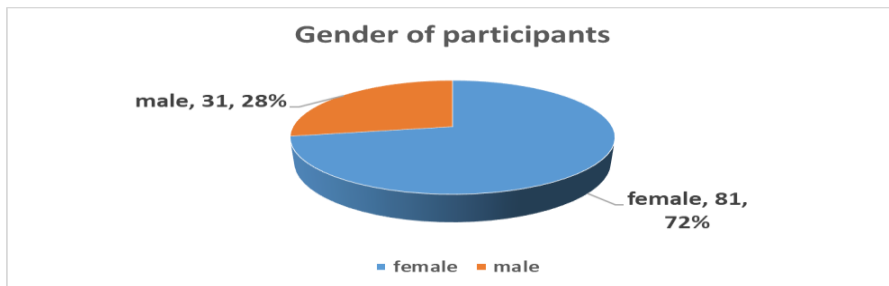
Graph (1): distribution of participants according to gender (N 112)

Graph (1) This graph shows the gender distribution among participants which 72 % of them were females and 28% were male.

Table (2) the distribution of the participants according to WATCH DM Score variables

RISK SCORE	<7 n=	8-9 n=	10 n=	11-13 n=	>14 n=	Total =112	Percentage
AGE YEARS							
<50	13	7	1	3	1	25	22%
50-54	8	2	1	2	2	15	13%
55-59	9	10	2	4	4	29	26%
60-64	0	4	2	10	6	22	20%
65-70	0	1	2	5	4	12	11%
70-74	0	0	1	3	5	9	8%
>75	0	0	0	0	0	0	0%
BMI							
<25	5	0	0	0	1	6	5%
25-34	10	7	2	6	6	31	28%
35-39	17	16	4	19	12	68	61%
>=40	0	1	2	1	3	7	6%
SBP							
<100	1	0	0	0	1	2	2%
100-139	17	13	6	14	4	54	48%
140-159	11	9	3	9	13	45	40%
>=160						11	10%
DBP							
<60	0	0	0	0	1	1	1%
60-80	16	12	8	20	16	72	64%
>=80	14	12	1	7	5	39	35%
FBG							
<125	5	4	3	3	2	17	15%
125-199	19	11	3	14	5	52	46%
200-299	6	7	1	4	5	23	21%
>=300	0	2	2	6	10	20	18%
QRS							
< 120	30	24	7	23	9	93	83%
>=120	0	0	2	4	13	19	17%
S.CR							
<1	30	18	8	17	11	84	75%
1-1.49	0	5	1	7	2	15	13%
>=1.5	0	1	0	3	9	13	12%
HDL							
<30	2	0	0	2	3	7	6%
30-59	28	24	9	25	19	105	94%
>=60	0	0	0	0	0	0	0%
PRIOR MI							
YES	0	0	0	7	5	12	11%
NO	30	24	9	20	17	100	89%
PRIOR GABG							
YES	0	2	0	1	1	4	4%

| NO | 30 | 22 | 9 | 26 | 21 | 108 | 96% |

Table 2 shows the distribution of the participants according to risk score variables,26% of participant are within age group 55-59 yrs,22% less than 50 years, 20% are within 60-64 years. 61% of the participant's class II obesity (35-39) and 28% are overweight and class I obesity (25-34).

Systolic blood pressure (100-139) was registered among 48% of the participants, and 40% of them registered systolic pressure (140-159), while64% of them registered diastolic blood pressure (60-80) and 39% (>80).

For fasting blood glucose 46% have their blood sugar within the range (125-199), 21%(200-299) and 18% have fasting blood sugar > 300 mg/dl.

QRS <20 mm was recorded among 83% of the participants, and serum creatinine was less than 1 among 75% of them while 94% registered HDL (30-59). 12 patients suffered from prior myocardial infarction and 4 only had undergone prior CABG.

DISCUSSION

The risk score, known as WATCH-DM, provides a novel prediction tool to identify patients who may face a heart failure (HF) with preserved ejection fraction (HFpEF) risk in the next five years, sample included 112 diabetic patients, mean WATCH-DM score mean± SD 10.39±3.6 and range 4-19, The overall high score in 24%and very high score was registered among19% of them while very low and low score was registered among 26% and 21 % of them respectively. The present study showed a lower WATCH-DM score to a similar study that mean score was 12.8±3.1 which involved a sample with older age group (age 80±9 years), with (35.2%) registered high score, and (39.0%) very high HF risk, while low score was registered among 25.8%. [15].

One quarter were of age group 55-59 years' age have been documented to increase the complications in diabetic patients, in an other study on diabetics in Baghdad, almost two quarters of the study group were above 50 years were above. [16,17].

Almost three quarters of them were females, although men have higher incidence of heart failure, both men and women have a comparable prevalence, since women tend to live longer so they are diagnosed in advanced age in comparison to men. [18].

Obesity may be dfined as increase in body fat and adipose tissue, leading to increased risk odf diabetes and cardiovascular disease in comparison to non obese adults. [19].

Two thirds of our patients suffer from class II obesity i.e. (BMI 35-39) and over a quarter are overweight and class I obesity (BMI 25-34), the combined adverse effect of diabetes and obesity (diabesity) confers a dual impact on the cardiovascular system leading to atherosclerosis, ischemia and eventual heart failure. [20].

Obesity and overweight are escalating in Iraq imposing risk of various non communicable diseases such as diabetes, hypertension, heart failure as well as cancer, in recent study done in Baghdad among healthy females (both adult and adolescent), among which obesity was registered among 9%, while overweight 24%. [21].

While among healthy adult men who were studied in another recent study, also in Baghdad, overweight was registered among 42% of them, while obesity was 27%. [22].

Almost half of the patients have systolic blood pressure in range of (100-139),40 % of them had systolic pressure within the range (140-159), while diastolic blood pressure occurred in range of (60-80) in 64% of the patients, the risk of heart failure was supported by a cohort study that documented lowering blood pressure among below 70 years' diabetes may lower heart failure risk. [23].

Poor glycemic control was noticed among the study sample, fasting blood sugar was in the range of (125-199) in nearly half of them, one fifth of them exhibit fasting blood sugar between (200-299), and almost one fifth have blood sugar equal or above 300 mg/dl. hyperglycemia is a key modifiable risk factor for coronary vascular disease, thus tight glycemic control may potentially reduce heart failure incidence. [24].

Majority of the study sample showed QRS < 120 mm, prolonged QRS duration is associated with increased cardiovascular risk [25].

Three quarters of the study sample showed a level of serum creatinine less than one, which yield a better prognosis since chronic kidney disease among diabetic patients increases the risk of heart failure. [26].

Majority of the study sample showed HDL level within the range (30-59), which is considered a positive finding since high density lipoprotein is a protective factor due to its anti-oxidant effect. [27]

Only twelve of our sample experienced prior myocardial infarction and four of them underwent CABG surgery, it has been documented that diabetes increases the complications and hence mortality among patients undergoing (CABG) surgery. [28].

CONCLUSION

Among our study sample 43% of patients have high and very high risk score of incident heart failure using WATCH-DM risk score, such risk assessment helps to apply early preventive measures through better glycemic control with other modifiable risk factors and will enhance better patient compliance when recognizing future heart failure risk.

The WATCH-DM risk score predicted functional capacity and prognosis in diabetic patients with HF with preserved ejection fraction (HFpEF).

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