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Assessment of Some Cardiac Markers (CK-MB, Myoglobin and Troponin) in Iraqi Type-2 Diabetic Patients with Metabolic Syndrome

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Abstract

Cardiovascular diseases in the context of diabetes represent a main cause of morbidity and mortality with a two to three times higher risk of cardiovascular diseases in T2DM patients than in people without the condition (normoglycemia). The current study aimed to assess some Cardiac markers (CK-MB, myoglobin and troponin) in Iraqi type two diabetic patients with metabolic syndrome. The study was carried out on (60) patients with type-2 *Diabetes mellitus* who were divided into 2 groups: (30) subjects having metabolic syndromes and (30) subjects without metabolic syndromes. Venous blood samples were taken from patients who visited the Medical City Hospital-Baghdad during the period from November 2024 to January 2025.The results demonstrated highly significant differences between metabolic syndrome and without metabolic syndrome groups in regard to TG and HDL ($p \leq 0.001$). In addition, there was a highly significant difference ($p = 0.001$) in CK-MB and Myoglobin levels between the two groups, and a significant variation was found in Troponin I levels between these groups ($p = 0.003$). We can conclude that a highly significant variation was found between individuals with type-2 diabetes having metabolic syndrome and subjects having no metabolic syndromes in regard to CK-MB, Troponin-1 and Myoglobin levels.

Keywords: Type-2 diabetes, CK-MB, Myoglobin, Troponin, Metabolic syndrome

1. Introduction

The metabolic syndrome (MetS), formerly known as Reaven Syndrome, Syndrome X or insulin resistance (IR) syndrome, is a group of risk factors which increase the atherosclerotic cardiovascular disease risks, type-2 diabetes as well as strokes (Fahed *et al.*, 2020). The identified 5 MetS components are: waist circumference according to ethnicity for abdominal obesity identification, high blood pressures, impaired levels of fasting blood glucose, higher levels and decreased HDL-cholesterol amount (Park *et al.*, 2021). When the cardiac muscles are stressed or damaged, the endogenous cardiac biomarker substances are secreted into the blood circulation (Jacob & Khan, 2018). Measuring such biomarkers is utilized to assist in diagnosing, risk assessment and management of acute coronary syndrome (ACS), which is a potential life-threatening disorder regarded as a sudden onset of persistent chest pain, one or both arms pain, shoulder pain, stomach ache, or jaw pain, dyspnea, nausea dizziness and sweating (Patibandla *et al.*, 2023). One of these cardiac biomarkers used for diagnosis of myocardial injuries in both symptomatic and asymptomatic people is the cardiac troponin (Wang *et al.*, 2020). The protein complex (Troponin), which is formed of three subunits with different functions and structures: troponin-C (Tn-C), troponin-T (Tn-T) & troponin-I (Tn-I) and present on the thin filaments of a striated muscle. The three troponin subunits as well as tropomyosin are positioned on the actin filaments and are important to regulate calcium-mediated cardiac and skeletal muscle contractions (Roever *et al.*, 2017; Chaudhury *et al.*, 2017). Creatine Kinase, which is a CK-MB isoenzyme, and found in two isoforms: CK MB-1 and CK MB-2, is a biomarker of choice to diagnose acute myocardial infarctions, and it is detected in the laboratory by summation of isoforms 1 and 2 (Li *et al.*, 2022). The heme protein Myoglobin (Myo) exists in the cardiac and skeletal

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muscles, and used also to diagnose early myocardial infarction in the laboratory, although it is not very cardio-specific (Eggers *et al.*, 2004). Because of their precision, accuracy, high sensitivity and specificity, the cardiac biomarkers are assessed and measured as indicator for normal biologic processes, pathogenic processes or even pharmacologic responses for treatment interventions in type-2 diabetic people, to help in decreasing the development of CVD risks in those patients (Oguoma *et al.*, 2015; Adedoyin & Adesoye, 2005; Basu, 2019).

2. Materials and methods

The study was carried out on (60) patients with type-2 Diabetes mellitus, who were divided into two groups: (30) subjects having metabolic syndromes and (30) subjects without metabolic syndromes. Venous blood samples were collected from the patients who attended to the Medical City Hospital-Baghdad during the period from November 2024 to January 2025. The blood samples were left to clot for 15 min. and stirred for 10 min. at 3000 rpm for obtaining serum samples. Levels of serum CK-MB, myoglobin and troponin were measured using the fluorescence immunoassay from cTnI/CK-MB/Myo Rapid Quantitative Test, China.

2.1. Statistical analysis

The SPSS-25 program was used for data analysis in this study. The Chi-square and t-test test were applied for comparing between variables. The ($P < 0.05$) value was considered as significant.

3. Results

The Table 1 showed that the (M ± SD) of age in the Type-2 diabetic patient group with metabolic syndrome was (49.83 ± 0.86) years, while in the Type-2 diabetic patient group without metabolic syndrome was (44.76 ± 0.91), with a highly significant variation ($P \leq 0.001$). Also, results in this table demonstrated that the highest prevalence rate in Type-2 diabetic subjects with metabolic syndrome 18 (60.0%) was within age group (45–54) yrs, whereas the highest prevalence rate in Type-2 diabetic subjects without metabolic syndrome 16 (53.3%) was within age group (35–44) yrs.

It was shown that the (M ± SD) of body mass index (BMI) in metabolic syndromes patients was (30.30 ± 0.75) kg/m^2 in comparison with the patients without metabolic syndromes (27.52 ± 0.82) kg/m^2, with a significant variation ($p \leq 0.01$), as shown in Table 2.

The results revealed that the (M ± SD) of TG in the group of diabetic patients with metabolic syndrome was (269.50 ± 10.76) compared to diabetic patient group without metabolic syndrome (177.56 ± 9.79), with a highly significant variation ($p \leq 0.001$). Also, the (M ± SD) of HDL in the subject group with metabolic syndrome is (34.70 ± 0.24) compared to the group of subjects without metabolic syndromes (44.26 ± 1.20), with a highly significant variation ($p \leq 0.001$), as observed in Table 3.

Table 4 indicated that (M ± SD) of (CK-MB) in diabetic subjects with metabolic syndromes is (4.90 ± 0.451) compared to diabetic subjects without metabolic syndromes (3.34 ± 0.238), with a highly significant variation ($p = 0.001$), and the (M ± SD) of (Troponin-1) in the diabetic subjects with metabolic syndromes is (0.0423 ± 0.00531) compared to diabetic

Table 1. Distribution of the study groups according to age.

	Study group (N, %)			
Age group (yrs)	Metabolic syndrome	Without MS	Total	P-value
(35–44)	4 (13.3%)	16 (53.3%)	20 (33.3%)	Chi-square = 13.45
(45–54)	18 (60.0%)	13 (43.3%)	31 (51.7%)	P = 0.001 (HS)
>54	8 (26.7%)	1 (3.3%)	9 (15.0%)	
Total	30 (100.0%)	30 (100.0%)	60 (100.0%)	
Age (M ± SD)	49.83 ± 0.86	44.76 ± 0.91	T-test = 4.02	P ≤ 0.001

Table 2. Distribution of the study groups according to Body mass index (Kg/m^2).

	Study group (N, %)			
BMI (Kg/m^2)	Metabolic syndrome (MS)	Without MS	Total	P-value
18.5–24.9	1 (3.3%)	10 (33.3%)	11 (18.3%)	Chi-square = 9.86
25–29.9	12 (40.0%)	11 (36.7%)	23 (38.3%)	P = 0.007 (HS)
>29.9	17 (56.7%)	9 (30.0%)	26 (43.3%)	
Total	30 (100.0%)	30 (100.0%)	60 (100.0%)	
BMI (M ± SD)	30.30 ± 0.75	27.52 ± 0.82	T-test = 2.48	P ≤ 0.01 (S)

Table 3. Distribution of study groups according to (TG) and (HDL) levels.

Parameter	Groups	Mean	SD	T-test	P-value
TG ()	Metabolic syndrome (MS)	269.50	10.76	6.31	P ≤ 0.001 (H.S)
	Without MS	177.56	9.79		
HDL ()	Metabolic syndrome (MS)	34.70	0.24	7.74	P ≤ 0.001 (H.S)
	Without MS	44.26	1.20		

Table 4. Distribution of study groups according to CK-MB, Troponin I and Myoglobin levels.

Parameter	Groups	Mean	SD	P-value
CK-MB ()	Metabolic syndrome (MS)	4.90	0.451	P = 0.001 (H.S)
	Without MS	3.34	0.238	
Troponin I ()	Metabolic syndrome (MS)	0.0423	0.00531	P = 0.003 (S)
	Without MS	0.0303	0.00354	
Myoglobin ()	Metabolic syndrome (MS)	60.93	4.247	P = 0.001 (H.S)
	Without MS	48.13	3.138	

subjects without metabolic syndromes (0.0303 ± 0.00354), with a significant variation (p = 0.003). The same table indicated that (M ± SD) of (Myoglobin) in diabetic subjects with metabolic syndromes is (60.93 ± 4.247) compared to the group of diabetic subjects without metabolic syndrome (48.13 ± 3.138), with a highly significant difference (p = 0.001).

4. Discussion

The main causes of deaths and disabilities in patients with *Diabetes mellitus* are the cardiovascular diseases (Grundy, 2016). Definition of metabolic syndromes includes the co-existence of many classical cardiovascular risk factors e.g. hypertensions, insulin resistance, elevated triglyceride and high-density lipoproteins (HDL) cholesterol (Duvnjak *et al.*, 2008). Thus, MtS is a collection of risk factors of different atherosclerotic cardiovascular disease (AlSaraj *et al.*, 2009). MtS is highly related to diabetes. In such kind of DM, insulin resistance and secondary hyperinsulinemias are present, and usually related to hypertension, dyslipidemias, atherosclerosis as well as most prominently, obesity, or central obesity in particular. The causes of metabolic syndrome are composed of separate constituents (like *Diabetes mellitus*, hypertensions and dyslipidemias) resulting in a complicated condition (Fahed *et al.*, 2020). In the current study, age was shown to be an important risk factor to develop complication of metabolic syndrome with type-2 diabeted as compared to T2DM without metabolic syndrome and this study agreed with Nanayakkara *et al.* (2021) who reported an inversely relation between age in diabetes diagnosis and risk of the main complications of DM following the adjustment of current age. In one study, it was demonstrated that 30.0% of abdominal obesities were seen in diabetic subjects without metabolic syndromes compared to 56.7% in diabetic subjects with metabolic syndromes. In their study, Cheng et al., stated that 91.6% of individuals with diabetes had abdominal obesity (Cheng *et al.*, 2014), which was higher than our results. The main risk factor for diabetes with MtS is the central obesity (Tyrovolas *et al.*, 2015), which also raises the risks of coronary artery diseases and dyslipidemias (Onat *et al.*, 2004). It was found in the current study that MetS is correlated with elevated cardiac failure hazards, CHDs and deaths, particularly in patients with higher subclinical myocardial injuries, and that such correlations are relatively weakened and often has no significance in patients without subclinical myocardial injuries e.g. (undetected hs-cTnT). The relationships between MetS constituents for cardiac failures, CHDs and deaths are usually higher with greater hs-cTn-T levels in group of subjects with the same number of metabolic syndrome constituents. In diabetic subjects with all metabolic syndromes constituents, there were highest hs-cTn-T levels with strongest hazards. There was a particular strong relationship with cardiac failure. Nevertheless, former tests of interaction between metabolic syndromes or their constituents and hs-cTn-T are non-significant in the majority of results (Witteles & Fowler, 2008; Scuteri *et al.*, 2015). This study showed significant elevated levels of plasma CK-MB in patient with metabolic syndrome cases when compared with the concentrations in persons without metabolic syndrome. This result is in agreement with the previous investigations, which reported that CK-MB level was significantly elevated in diabetic people with established MS complications (Scuteri *et al.*, 2015). Furthermore, it was found that the level of CK-MB elevated in diabetic subjects with metabolic syndrome than diabetic patients without metabolic syndrome (Sun *et al.*, 2014; Strunz *et al.*, 2011). Numerous investigations showed that diabetic individuals have

more risk factor of myocardial infarction than nondiabetic individuals. Different studies stated that during acute MI, the cardiac enzyme CK-MB, myoglobin and troponin levels increase in the blood (EH Schwarz, 2011). Another evaluating study reported that cardiac marker CK-MB and troponin levels were increased in diabetic patients with myocardial infraction complication. Increased levels of creatine kinase, especially, CK-MB, usually happen within hours in people who experience cardiac attacks, this increase emerges as a result of heart muscle death. Therefore, testing of the creatine kinase level confirms the occurrence of a cardiac attack (Weckbach *et al.*, 2009).

5. Conclusion

The study concludes that there is a highly significant difference in CK-MB, Troponin-1, and Myoglobin levels between patients with type 2 diabetes who have metabolic syndrome and those who do not have metabolic syndrome.

Authors' contributions

Obtaining data, editing, writing; experimental measurements; all performed by corresponding author.

Conflict of interests disclosure

No conflict of interests.

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