The Relation between Blood Sugar Level and Cholesterol and Triglyceride and some Factors in Heart Failure Patients Hospitalized in Tohid Medical Center of Sanandaj in 2013-2014

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Abstract: Heart failure is the major health problem in developed countries. Obesity, high blood pressure, high cholesterol, smoking, and alcohol consumption are the most important causes of cardiovascular diseases. On the other hand, diabetes mellitus is also the most common metabolic disorder in endocrine glands which can be an independent risk factor for cardiovascular diseases. In this regard, the present study was aimed at investigating the relation between blood sugar level and cholesterol and triglyceride and some factors in heart failure patients hospitalized in Tohid medical center of Sanandaj in 2013. **Method:** The research was an analytic-descriptive study conducted on 256 heart failure patients hospitalized in the cardiology ward of Tohid medical center, Sanandaj in 2012-2013. Simple random sampling was utilized. A questionnaire including 7 items about demographic information and 3 questions on the level of cholesterol-triglyceride and blood sugar was applied. Ten hours after the failure and when the patients were hospitalized and fasting, blood sampling was conducted. Blood sugar was considered in form of hypoglycemia FBS<50, normal 50<FBS<110, hyperglycemia FBS>110. Level of blood cholesterol was considered in two normal forms (less than and equal to 200). Hypercholesterolemia was more than 200. And blood triglyceride was considered in two normal forms (less than and equal to 250). And hypertriglyceridemia was more than 250. Descriptive statistics was utilized to describe the collected data and data analysis was conducted through chi-square test, Fisher's exact test, and odds ratio (OR). **Findings:** Out of 256 studied patients, 195 (76.2%) were male and 61 (23.8%) were female. The patients' mean age was 62.4 with a standard deviation of 12.92 and age range of 35-87. In this study, there was no significant relation between level of fasting sugar blood and patients' gender (P=0.45), age group (P=0.21), smoking (P=0.83), record of hyperlipidemia (P=0.32), and record of high blood pressure (P=0.80). However, there was a significant relation between record of diabetes and sugar blood (OR=3.38, CI 95%, 1.50: 7.78). There was also a significant relation between level of cholesterol and fasting blood sugar (OR=2.9, CI 95%, 1.49: 5.70). **Discussion:** Although diagnosing and treating diseases have experienced a lot of developments, there are still some risk factors such as blood sugar disorder, central obesity, high blood pressure, and dyslipidemia which are labeled as metabolic syndromes and related to risk of an increase in cardiovascular diseases. In the present study, mean age of the patients was reported to be 62.4 while it is 67 in European countries. A significant relation was observed between level of cholesterol and fasting blood sugar while in other studies it has been reported that impaired glucose tolerance does not increase risk of cerebrovascular cases and coronary artery diseases. There was a significant relation between level of triglyceride and record of high level of blood sugar. Research has showed that blood sugar disorder, regardless of its intensity, increases risk of cardiovascular diseases. Blood sugar and metabolic syndrome are high among Iranians. Therefore, intensive attention needs to be devoted to these factors in health enhancement programs.

Introduction

Heart failure is the major health problem in developed countries [1]. Nowadays, myocardial infarction (MI) is one of the most common causes of hospitalizing patients [2]. In developing countries, due to aging population and rapid change in lifestyle especially smoking, consuming foods with high level of fat, inactivity, and taking industrialized life patterns, risk factors and rate of cardiovascular diseases are growing [3 & 4]. According to the reports of World Health Organization (WHO) in 2002, obesity, high blood pressure, high level of cholesterol, alcohol consumption, and smoking are mentioned as the most important causes of cardiovascular diseases [5]. Therefore, metabolic syndrome is related to risk of cardiovascular diseases [6]. Iran is one of the Southwest Asian countries, where prevalence of such factors is quite common. Coronary artery diseases are the primary cause of death in various nations [7, 8, & 9]. Evidence has showed that intensity and prevalence of these diseases vary in different regions of the country [10]. According to various reports in Iran, more than 40% of deaths are caused by cardiovascular diseases. Respectively, in Isfahan and Markazi provinces 34.2% and 32.2% of people carry at least one risk factor and 19.3% and 15% of them have at least two risk factors. Low intense cholesterol has been introduced as the most common risk factor in these studies [11]. High rate of death caused by coronary artery disease in Iran necessitates finding effective methods to decrease these diseases and deaths caused by them. According to the results of the related studies, the prevalence of blood sugar disorder and cardiovascular diseases is high [12 & 13] and the rate of deaths caused by these diseases is high in Iran and they are the primary cause of death [14 & 15]. Brown Wald states that in the end of 20th century deaths caused by cardiovascular diseases account for approximately half and one-fourth of deaths in developed developing countries, respectively [16]. It has been predicted that in 2020 about 25 million deaths per year will be caused by cardiovascular disorders. Diabetes increase, smoking, and dyslipidemia are major independent risk factors of coronary heart diseases [17] and blood sugar disorder increases the risk of cardiovascular diseases [18]. Zaliunas' study concluded that half of diabetes patients are prone to heart failure [19. Diabetes is a chronic disease that involves all aspects of the individual's life and its treatment requires fundamental changes in the person's lifestyle [20]. Diabetes mellitus is the most common metabolic disorder of internal glands in human communities its prevalence is between 2-8 percent [21]. Possibility of cardiovascular diseases and diabetes among these

individuals is 4-5 percent per year. It has recently been distinguished that this condition can solely be an independent risk factor [22]. There has lately been more attention to this issue that after-eating disorder is an important factor in the development in atherosclerosis and even in diabetes mellitus [23]. Since chronic diseases especially atherosclerosis, high blood pressure, and its complications are the most important health problems in undeveloped and developed countries, the present study was conducted to investigate the relation between blood sugar level and cholesterol and triglyceride and some factors in heart failure patients hospitalized in Tohid medical center of Sanandaj in 2013.

Method and Materials

The research was an analytic-descriptive study conducted on 256 heart failure patients hospitalized in the cardiology ward of Tohid medical center, Sanandaj in 2012-2013. Simple random sampling was utilized. A questionnaire of ten questions was utilized as the instrument. It included 7 items about demographic information and 3 questions on the level of cholesterol-triglyceride and blood sugar. Ten hours after the failure and when the patients were hospitalized and fasting, blood sampling was conducted. After permission was gained from the authorities of Tohid medical center, data collection was conducted. Patients and their companies were interviewed in order to collect demographic information. Fasting blood sugar test was conducted through enzyme glucose oxidase and lipid (cholesterol and triglyceride) was measured using a spectrophotometer and an automated analyzer system. Collected data were recorded. Blood sugar was considered in form of hypoglycemia FBS<50, normal 50<FBS<110, hyperglycemia FBS>110 [24]. Level of blood cholesterol was considered in two normal forms (less than and equal to 200). Hypercholesterolemia was more than 200. And blood triglyceride was considered in two normal forms (less than and equal to 250). And hypertriglyceridemia was more than 250 [25]. Collected data were analyzed using SPSS 16 software. Descriptive statistics was utilized to describe the collected data and data analysis was conducted through chi-square test, Fisher's exact test, and odds ratio (OR).

Findings

Out of 256 studied patients, 195 (76.2%) were male and 61 (23.8%) were female. The patients' mean age was 62.4 with a standard deviation of 12.92 and age range of 35-87. Record of high blood pressure was observed for 26.6% of the patients, 6.6 percent had experienced hyperlipidemia, and 16.4 percent had experienced diabetes. Moreover, 39.8 percent of the participants were smokers. In this study, there was no significant relation between level

of fasting sugar blood and patients' gender (P=0.45), age group (P=0.21), smoking (P=0.83), record of hyperlipidemia (P=0.32), and record of high blood pressure (P=0.80). However, there was a significant relation between record of diabetes and sugar blood (OR=3.38, CI 95%, 1.50: 7.78). There was also a significant relation between level of cholesterol and fasting blood sugar (OR=2.9, CI 95%, 1.49: 5.70).

Table 1. Frequency Distribution of Level of Blood Lipid and Blood Sugar in Studied Patients

Number (Percentage)	Variable	
195 (76.2)	200≥	Cholesterol
61 (23.8)	200<	
243 (94.9)	250≥	Triglyceride
13 (5.1)	250<	
120 (46.9)	50-110	Blood Sugar
136 (53.1)	110<	

Table 2. The Relation between Triglyceride and Record of Blood Pressure in Studied Patients

No Number (%)	Yes Number (%)	Record of High Blood Pressure Level of Triglyceride
182 (74.9)	61 (25.1)	Less than 250
6 (46.2)	7 (53.8)	More than 250
188 (73.4)	68 (26.6)	Total

Discussion

Although diagnosing and treating MI have recently experienced a lot of developments, this disease is still an important problem in health system of countries [26] and heart diseases is the most common cause of mortality and morbidity in today's societies. In the last two decades, geographical distribution of heart diseases has changed and WHO has regarded prevention of these diseases as one of the health priorities [27]. According to the predictions, by 2020 cardiovascular diseases (especially atherosclerosis) will be the most prevalent diseases that reduce individuals' efficiency due to disability and premature death. Acute MI, caused mainly by coronary atherosclerosis and thrombosis, is one of the main causes of hospitalization in industrialized countries [28]. Some risk factors include blood sugar disorder, central obesity, high blood pressure, and dyslipidemia which are labeled as metabolic syndromes and related to risk of an increase in cardiovascular diseases [6].

In this study, 76.2% and 23.8% patients with MI were male and female, respectively. Due to protective effect of sex hormones, women are less prone to coronary heart disease compared to men [29]. In other studies, it is also reported that most MI patients are male [31 & 32]. Smeltzer and Bare state that incidence of coronary heart disease is remarkably less in women of 55 compared to men; and this is because of protective effect of estrogen [32]. In their study, Shamsi and Thom have reported higher rate of cardiovascular disease among men [33 & 34].

Participants' mean age was 62.4 with a standard deviation of 12.92 and range of 21-93. In studies conducted in European countries, mean age of heart failure incidence has been reported as 67 [35].

Table 3. Relation between Patients' Level of Blood Sugar and other Variables

OR (CI 95%)	p	Normal (less than 110) Number (%)	Abnormal (more than 110) Number (%)	Blood Sugar Variable	
0.81 (0.44: 1.51)	0.45 *	94 (78.3)	103 (74.3)	Male	Gender
		26 (21.7)	35 (25.7)	Female	
--	0.21 **	4 (3.3)	2 (1.5)	39 and less	Age Group
		39 (32.5)	57 (41.9)	40-59	
		77 (64.2)	77 (56.06)	60 and more	
1.05 (0.62: 1.8)	0.83 *	47 (39.2)	55 (40.4)	Yes	Smoking
		73 (60.8)	81 (59.6)	No	
1.67 (0.55: 5.27)	0.32 *	6 (5.0)	11 (8.1)	Yes	Record Hyperlipidemia
		114 (95.0)	125 (91.9)	No	
1.07 (0.59: 1.94)	0.80 *	31 (25.8)	37 (27.2)	Yes	Record of High Blood Pressure
		89 (74.2)	99 (72.8)	No	
3.38 (1.50: 7.78)	0.001 *	10 (8.3)	32 (23.5)	Yes	Record of Diabetes
		110 (91.7)	104 (76.5)	No	
2.9 (1.49: 5.70)	0.0006 *	17 (14.2)	44 (32.4)	200 <	Cholesterol
		103 (85.8)	92 (67.6)	200 ≥	
2.06 (056: 8.17)	0.23 **	4 (3.3)	9 (6.6)	250 <	Triglyceride
		116 (96.7)	127 (93.4)	250 ≥	
				* Chi-square ** Fisher's Exact Test	

In her study conducted in Iran, Mazaheryun reported age of heart failure incidence as 57 [36]. Old age, male sex, and family history are non-modifiable risk factors. As age increases, likelihood of atherosclerosis incidence soars. Coronary diseases are often common among individuals over 40 [25]. Generally, incidence of atherosclerosis increases with age and coronary diseases usually occur in men over

Table 4. Relation between Level of Triglyceride and Patients' Record of High Blood Pressure

N Number (%)	Yes Number (%)	Record of High Blood Pressure Level of Triglyceride
206	37 (88.1)	Less than 250
8 (3.7)	5 (11.9)	More than 250
214	42 (100)	Total

p = 0.044

45 and women over 55 [32]. In their study conducted in the USA, Seroguchi *et al* have concluded that women with MI are older than men with the same disease [37]. High blood pressure was observed among 26.6 percent of MI patients. Hypertension can remarkably heighten the possibility of getting atherosclerosis. This possibility increases with blood pressure [25]. Epidemiological studies have proved the relation between hypertension and atherosclerosis incidence [38]. Experience of hyperlipidemia was observed among 6.6 percent of patients with heart failure. Disorders of hyperlipidemia and blood pressure are the most important risk factors of coronary heart diseases [39]. Studies have showed that even in individuals with low level of normal fasting lipid, triglyceride-rich lipoproteins clearance disorder is related to atherosclerosis [40].

Experience of diabetes was observed among 16.4 percent of the patients. Other studies also introduced diabetes as the main cause of hospitalization. Smoking record was 39.8% among the participants. Smoking increases risk of coronary artery diseases 2-3 times [25]. Risk of sudden death due to cardiac arrest is about 10 times higher in people who smoke compare to those who do not [32]. Dyslipidemia is one of the most important risk factors for cardio vascular in type 2 diabetes [41]. In the present study, level of cholesterol more than 200 was observed among 23.8 percent of the patients. In Marrakesh, cholesterol level more than 200 was observed among 29 percent of the individuals [42]. Moreover, level of triglyceride more than 250 was observed among 5.1 percent of the patients. In Iran, triglyceride disorder in towns and villages are respectively reported as 25.6% and 23.1% [43]. Level of fasting sugar blood of over 110 was observed among 53.1 percent of the patients. Numerous studies have showed that patients with heart infraction

disease usually have impaired glucose tolerance [44]. In a study conducted in Iran, mean cholesterol level was 176, triglyceride level was 141, and fasting sugar blood was 100 [36].

There was a significant relation between fasting sugar blood and record of high blood sugar. Smith states that metabolic disorders like diabetes, dyslipidemia, smoking, high blood pressure, and inactivity and obesity are among the known risk factors of cardiovascular diseases [45]. There was statistical relation between level of blood sugar and record of high blood sugar. In their study, Chiu and Jose tried to screen diabetes and faced with hyperlipidemia [46 & 47]. In Hadaegh's study, the prevalence of hypercholesterolemia and metabolic syndrome elements, regardless of their glucose status, was higher in individuals with metabolic syndrome [48]. Some studies; however, have reported that impaired glucose tolerance does not increase the risk of new cases of coronary and cerebrovascular diseases [49].

In the present study, 67.6 percent of the patients whose fasting blood sugar was over 110 had cholesterol level of less than 200. The relation; however, was statistically significant and patients whose fasting blood sugar was below 110, 85.8 percent of them had cholesterol level less than 200. In the last decade, lipids and related compositions in ill and healthy individuals' plasma have drawn a lot of attention and are introduced as risk factors for cardiovascular diseases [50]. In this study, there was no relation between level of fasting blood sugar and triglyceride. The researchers believe that results may differ if more participants are regarded. In a study conducted over 3 years, it has been showed that there is no relation between HDL and triglyceride and cardiovascular consequences [51]. Fasting blood sugar in 91.7 percent of heart failure patients who had never experienced diabetes was lower than 100. The results of the study proved a significant relation (P=0.000). Triglyceride in 98.5 percent of the participants who had cholesterol level less than 200 was less than 250 (P=0.000). In HUG's study, it was concluded that patients with metabolic syndrome were more prone to cardiovascular diseases [52]. There was a significant relation between level of cholesterol and record of high blood sugar (P=0.02) so that 85.1 percent of the participants with diabetes record had cholesterol level of less than 200.

There was a significant relation between level of triglyceride and record of high blood pressure (P=0.022). Triglyceride level in 74.9 percent of the patients who did not experience high blood pressure was less than 250. Moreover, triglyceride level in 53.8 percent of the patients who had experienced high blood pressure was more than 250.

In their study, Jalal Khan Abadi *et al* have concluded that individuals who have experienced heart failure not only have higher cholesterol and lipoprotein but also have significantly higher level of triglyceride level compared to those who had never experienced it. The results of the present study proved the important role of cholesterol in causing heart failure [53].

There was a significant relation between level of triglyceride and high blood sugar. A significant relation was observed between level of triglyceride and record of high blood sugar. Level of triglyceride in 38.5 percent of the patients with record of diabetes was over 250. Research suggests that blood sugar disorder, regardless its intensity, increases risk of cardiovascular diseases [18]. Prevalence of blood sugar disorder and metabolic syndrome is high among Iranians [12].

In some individuals, record of premature heart failure in their parents is one of the factors disposing the children to risk factors of coronary heart diseases and especially high blood pressure and hyperlipidemia [54]. The results of Hadaegh's study concluded that interfering programs need to be organized in terms of prevention of high blood pressure and hyperlipidemia in order to prevent cardiovascular diseases to occur [48]. Since four modifiable factors are introduced as main risk factors in coronary artery diseases and their complications; therefore, more attention needs to be given to these factors in health improvement programs [32].

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