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Research Article

Assessment of Cardiovascular Risk Factors and Selected Clinical Parameters in Patients Admitted to the Cardiac Surgery Intensive Care Unit

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ABSTRACT

Background: Cardiovascular diseases are the leading cause of mortality worldwide. Numerous risk factors contribute to cardiovascular diseases. Identifying individuals at high risk and ensuring they receive appropriate treatment can prevent premature deaths. This study aimed to "determine cardiovascular risk factors and some clinical parameters in patients admitted to the cardiac surgery intensive care unit."

Methods: This study employed a cross-sectional design and was conducted on 109 patients admitted to the cardiac ICU of a central Tehran hospital. Samples were selected using convenience sampling based on inclusion criteria. Data were collected using a researcher-developed questionnaire and analyzed using SPSS version 25 with statistical tests.

Results: The average age of the participants was 61.05±8.5 years. The majority of the sample was male (73.3%). The prevalence of diabetes and hypertension in the patients was 66.1% and 45.9%, respectively. The average BMI of the patients (25.9±3.6) was above the normal range. The mean blood glucose (153.26±36.65), cholesterol (151.7±36.2), triglycerides (135.85±51.9), kidney enzymes, and arterial blood gases were within acceptable ranges.

Conclusion: Risk factors for cardiovascular diseases (particularly high weight and obesity, diabetes, and hypertension) are prevalent in patients undergoing cardiac surgery. Accordingly, planning and education are recommended to control and reduce cardiovascular disease risk factors in these patients.

Introduction

Cardiovascular diseases (CVDs) are the leading cause of death globally. According to the World Health Organization, these diseases cause approximately 18 million deaths each year [1]. Statistics show that more than 75 percent of these deaths due to cardiovascular diseases occur in low-income countries [2]. According to the GBD (Global Burden of Disease) data, in Iran in 2021, cardiovascular diseases accounted for 29.7% of all deaths (over 169,000 deaths) and 14.9% of DALYs (disability-adjusted life years). This rate of disability and mortality in Iran is higher than the global average, which further emphasizes the need to pay attention to this issue [3]. Sarebanhassanabadi et al. (2024), reported a significant increase in cardiovascular diseases and their risk factors in a 10-year cohort study conducted in Iran. The researchers also reported a low level of patient awareness and a very concerning level of disease management by patients themselves, highlighting the necessity of fundamental planning in this area [2].

There are many risk factors for cardiovascular diseases. They generally include unhealthy behaviors (such as

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alcohol and cigarette consumption, low physical activity, unhealthy food intake, etc.) and physiological factors (such as high blood pressure, high blood fat and sugar). Accordingly, the risk of cardiovascular diseases can be reduced by quitting smoking, exercising, reducing salt intake in the diet, eating healthy foods, etc. [1]. Saki et al. (2022) reported in a study that individuals with risk factors (including low physical activity, smoking, obesity, high blood pressure and cholesterol, and mobile phone use) have a higher chance of developing cardiovascular diseases. Individuals with more risk factors are significantly more likely to develop heart disease [4]. In addition to well-known clinical risk factors, other clinical parameters are also effective in health management and improving outcomes for patients undergoing cardiac surgery. Hougen et al. (2021) showed in a study that hyperkalemia can cause hospitalization and prolong the length of stay in patients. Hyperkalemia is also closely associated with serious cardiac problems and patient mortality [5]. In the study by Palaka et al., cardiovascular complications and hospitalization time were increased following hyperkalemia [6]. Studies have shown a close and significant association between kidney tests (such as BUN and creatinine) and mortality from cardiovascular disease [7]. In this regard, Bagheri et al. showed in a study that blood urea nitrogen levels, creatinine, and arterial blood gases are of particular importance in patients admitted to the cardiac surgery ICU, as these parameters are affected by cardiac surgery and intraoperative anesthesia management. These researchers recommend further research in this area [8]. Screening patients and people at risk for heart disease and treating them promptly can reduce mortality rates. The World Health Organization places great emphasis on the need for access to medicine, treatment, and counseling for all people in need [1]. Given the high importance of CVDs and their risk factors, as well as the recommendation of researchers and the WHO to conduct research in this area [1-4], the present study aimed to determine cardiovascular risk factors and some related clinical parameters in patients hospitalized in the cardiac surgery intensive care unit.

Methods

This cross-sectional study was conducted in 2013 on 109 patients admitted to the cardiac ICU of Tehran Heart Center. The sample size was determined using previous studies and the sample size formula. A statistical power of 90%, a confidence level of 95%, and a correlation coefficient of 1.5 were considered. Based on these parameters, the calculated sample size was 100 patients. Considering potential attrition, a total of 110 individuals were initially considered. Due to incomplete data, one patient was excluded during the study, and ultimately, data from 109 patients were analyzed. Following acquisition of necessary permissions and adherence to research ethics principles, convenience sampling was conducted based on the inclusion criteria. Inclusion criteria consisted of patient consent and admission to the cardiac intensive care unit. Exclusion criteria included incomplete questionnaire completion and willingness to withdraw from the study.

Information was recorded using a demographic questionnaire (sex, age, body mass index, medical history, duration of ventilator uses after surgery, and duration of ICU hospitalization) and clinical parameters related to cardiovascular diseases specific to patients admitted to the intensive care unit. These clinical parameters included cardiac output (EF), heartbeat, O2 saturation, blood pressure, lactate concentration, troponin, sodium, potassium, blood glucose, blood lipids, blood urea nitrogen, serum creatinine, hemoglobin, hematocrit, and blood gas analysis. Body mass index was calculated for the patients and the patients were divided into four groups: underweight (BMI < 18.5), normal (18.5 to 24.9), overweight (25 to 29.9), and obese (BMI > 30) [4]. Patients' blood pressure was measured and recorded using cardiac monitoring equipment while they were lying supine on a hospital bed. All blood tests were taken by experienced laboratory personnel employed at the hospital and analyzed using a standard device located in the hospital.

The researchers adhered to ethical principles in research throughout all stages of the study, respecting the human values of patients, obtaining informed consent, and maintaining confidentiality. All collected data were reported in aggregate rather than individually. Furthermore, the data lacked any personal patient information such as names, surnames, identification numbers, national codes, or any other personal identifiers. The data from this study were analyzed using SPSS version 25.

Results

The average age of the participants was 61.05±8.5 years. The majority of the sample was male (73.3%). The patients' mean body mass index (25.9±3.6) was above the normal range. Other demographic characteristics are presented in (Table 1).

Table 1- Patient demographic variables

Variable		Frequency	Percentage
Gender	Male	80	73.3
	Female	29	26.7
History of	Yes	72	66.1
Diabetes	No	37	33.9
History of	Yes	50	45.9
Hypertension	No	59	54.1
Variable		**M±SD**	
BMI		25.9±3.6	

Ventilation time (hour)	7.2±2.6
ICU stay (hour)	32.6±10.0

The study results showed that the mean systolic and diastolic blood pressures in patients were 113.85±10.9 mmHg and 64.85±9.9 mmHg, respectively. The mean heart rate of the patients was 86.4±12.4 beats per minute. The mean blood glucose (153.26±36.65), cholesterol (151.7±36.2), triglycerides (135.85±51.9), kidney enzymes, and arterial blood gases were within acceptable ranges. The mean of other clinical parameters is presented in (Table 2).

Table 2- Clinical parameters in patients

Variable	M±SD N=109
Na (mg/dl)	134.85±10.36
K (mg/dl)	4.46±0.70
Blood glucose (mg/dl)	153.26±36.65
Lactate	14.26±4.67
Triglyceride (mg/dl)	135.85±51.9
Cholesterol (mg/dl)	151.7±36.2
BUN (mg/dl)	23.32±8.16
Creatinine (mg/dl)	1.11±0.66
Hemoglobin (g/dl)	10.65±1.59
Hematocrit (%)	28.9±4.5
Troponin	7.37±4.55
pH	7.35±0.07
pCO2	35.18±7.36
PaO2	205.45±92.45
HCO3 (mg/dl)	22.05±2.15

Discussion

Screening patients and people at risk for heart disease and treating them promptly can reduce mortality rates. The World Health Organization places great emphasis on the need for access to medicine, treatment, and counseling for all people in need The most important behavioral risk factors for cardiovascular disease include high blood fat and sugar levels, high blood pressure, and excess weight [1]. The results of our study showed that most patients had at least one cardiovascular disease risk factor, including hypertension, hyperlipidemia, diabetes, and obesity. Najafpour et al. found in a study in Kerman that approximately 60% of patients had at least two coronary artery disease risk factors, and only 7% had no risk factors. These researchers suggest that, given the aging population of Iran, serious measures should be taken to reduce risk factors and the heavy burden on the country's healthcare system because almost all of these risk factors are preventable [9]. Other similar studies in Iran also showed that risk factors associated with CVDs were high [2, 4]. The present study revealed a high prevalence of diabetes (66.1%) and hypertension (45.9%) among patients admitted to the ICU. Furthermore, the patients' mean fasting blood glucose (153.26 mg/dl) was above the normal range, despite being on medication in the ICU. However, systolic and diastolic blood pressure levels were maintained within acceptable limits. Multiple studies have established the role of diabetes and hypertension as risk factors for cardiovascular diseases [1-3, 8]. The findings of Sarebanhassanabadi et al. indicated that hypertension is an important risk factor for cardiovascular diseases that can be modified and controlled. hypertension is also associated with the development of 71.6% of coronary artery disease cases. These researchers reported the prevalence of hypertension in Iran to be 29.5%, higher than countries like Somalia (26.4%). They also noted that blood pressure control with medication in the Iranian population is among the lowest (40.9%) [2]. In our study, the prevalence of hypertension (45.9%) was higher than in the aforementioned study [2], but the average blood pressure (systolic and diastolic) of patients at the time of the study was within an acceptable range. This finding highlights the necessity of continuous blood pressure monitoring in patients after cardiac surgery and admission to the cardiac ICU. The importance of this issue is such that injectable medications are used by specialists if needed. In these units, patients are constantly monitored by specialist physicians and experienced nurses and are treated precisely. Conversely, the average blood glucose level of patients in the present study was above the normal range. Also, the prevalence of diabetes was significantly high. Studies conducted on diabetes in Iran have reported the prevalence of this disease as 17% [2] and 14.1% [10] in another study, which are lower than in our study. A possible reason for the high percentage of diabetic patients in our study could be that the samples were selected from cardiac surgery patients in the hospital. Studies have shown that hyperglycemia (higher than normal blood sugar) can increase cardiovascular disease and its consequences [2, 11-12]. Therefore, the treatment team's attention to monitoring and controlling blood sugar, even in patients without diabetes, is of great importance to improve cardiovascular disease, which should also be considered after discharge from the hospital. A comprehensive approach to diabetes management is required. Considering the impact of this disease on coronary vessels, their management and control are also of high importance [2]. In addition to medical treatments, this approach should include factors such as mental health, environmental influences, self-efficacy, and social support [13].

In the present study, the average BMI of 25.9 is higher than the normal average, indicating that most patients in this study are overweight or obese. The results of a study by Sarebanhassanabadi et al. in Iran showed that obesity increases the probability of developing coronary artery disease by 53.6% [2]. The prevalence of obesity in a study in the city of Kerman was 43% [9]. Arjmand et al. state that above-normal weight is a factor in the

development and progression of heart disease. These researchers suggest using obesity indices to screen individuals at risk [14]. Since the patients in the present study had severe heart disease, weight gain and obesity due to inactivity resulting from the illness are expected. However, considering the presence of multiple risk factors in these patients, weight loss programs under the supervision of relevant specialists should be prioritized in their care plans after discharge from the hospital.

The results of patient tests in our study showed that the average levels of blood lipids, kidney enzymes, arterial blood gases, lactate, and blood potassium were within acceptable ranges. Elevated BUN can lead to serious complications in hospitalized patients at risk for heart disease [7]. Kazory, in a systematic review after examining the results of several articles, reported that blood urea nitrogen and creatinine play a role in predicting outcomes in cardiac patients. Higher BUN levels can lead to worse acute and chronic outcomes for cardiovascular patients [15]. In this regard, Lan et al. demonstrated that BUN is a valuable predictive marker for cardiovascular diseases, with higher BUN levels (above 13.51 mg/dL) associated with an increased incidence of heart failure [7]. This highlights the necessity for relevant specialists to pay attention to kidney function tests and their role in the successful management and treatment of CVDs patients.

The role of potassium in cardiac function has been proven in numerous studies. Abnormal blood potassium levels can also cause severe complications for cardiovascular patients [6]. In this context, Fan et al., in a meta-analysis reviewing 31 articles, demonstrated that abnormally low potassium and hyperglycemia can significantly increase mortality in cardiovascular diseases. Ultimately, these researchers concluded that potassium homeostasis improves cardiovascular disease outcomes, especially in hospitalized patients with cardiovascular disease [16]. In the present study, the average blood potassium level of patients hospitalized in the intensive care unit was within the acceptable range, which is considered one of the strengths of the treatment of these patients. Another strength and highlight in the tests of the patients in the present study was that the average blood lipid levels (cholesterol and triglycerides) were within the acceptable range. One of the reasons for this finding could be that these patients were treated under the supervision of cardiologists even before hospitalization. This is despite the fact that the relationship between high blood lipids and CVDs and its increased outcomes has been reported in various studies [4, 11, 17]. Also, the acceptability of the average of all arterial blood gas parameters of the patients in the present study could indicate the continuous, scientific, and careful monitoring, care, and treatment of the treatment team in the intensive care unit. Considering that the present study was conducted in the Tehran Heart Center Super Specialty Hospital, which is one of the best hospitals in the country, this is to be expected.

In the present study, the mean hemoglobin (10.65) and hematocrit (28.9) of patients admitted to the cardiac ICU were low. The low hemoglobin and hematocrit could be due to the fact that the data of this study was collected after the patients underwent cardiac surgery. In this context, Sadeghi et al. reported in a study of Patients Undergoing Cardiac that bleeding is commonly seen during and after cardiac surgery, which causes postoperative anemia. If patients are anemic before surgery, they will need a blood transfusion. 39.1% of patients received blood during or after surgery. These researchers emphasized that blood transfusion is associated with complications such as the risk of infection, atrial fibrillation, acute kidney injury, stroke, acute respiratory illness, and increased length of hospital stay [18]. Jahangirian et al. also reported in a study that the amount of blood transfusions given to patients undergoing cardiac surgery exceeded the recommendations of relevant guidelines, and given the reports of complications resulting from blood transfusion, such as increased infection, ischemic events after surgery, heavy financial costs, increased length of hospital stay, and mortality, it is recommended that interventions be implemented to manage the consumption of blood and its products [19]. Given the results of the above research and the careful monitoring of the treatment team in the hospital studied, the mean hemoglobin and hematocrit in the present study are expected given the patients' conditions.

Conclusion

Risk factors for cardiovascular diseases (particularly high weight and obesity, diabetes, and hypertension) are prevalent in patients undergoing cardiac surgery. The average clinical parameters were within acceptable ranges considering the patients' conditions. Accordingly, necessary planning and education are recommended to manage and reduce CVDs risk factors in these patients. It is also suggested that education and monitoring programs after discharge of these patients be considered by the relevant authorities.

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