

ORIGINAL PAPER

INCIDENCE OF SUDDEN CARDIAC DEATH IN ŽIVINICE
MUNICIPALITY, BOSNIA AND HERZEGOVINA,
DURING THE YEAR 2007¹Esed OMERKIĆ²Fahir BARAKOVIĆ²Zumreta KUŠLJUGIĆ³Mirsada PRAŠO⁴Azem POLJIĆ¹Mirsad BIJELIĆ¹Salih MULAGIĆ¹Department of Emergency Medical
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ABSTRACT

Introduction: sudden cardiac death (SCD) is an unexpected natural death due to cardiac causes in a short time period in a person with or without preexisting heart disease. Incidence of SCD in general population is 1/1000 inhabitants.**Aims:** to determine the incidence of SCD at a territory of Živinice municipality.**Patients and methods:** this study is a prospective examination of SCD by using the data from death certificates, data received from interviews with competent physicians, witnesses and family members. Definition and criteria of SCD by European Society of Cardiologist and American Heart Association from 2001 and use of International Classification of Diseases, version 10, were applied to determine the number of SCD.**Results:** sudden cardiac death is the single most frequent cause of death in inhabitants of the Živinice municipality. The incidence of SCD at the municipal Živinice was 1.4 cases per 1000 inhabitants per year. Mean age was 66.3 (± 12.6) years; in average, men were 7.2 years younger than women. The risk for SCD was 1.24-fold higher in men than in women. Correlation between the age and numbers of SCD was high ($r=0.89$; $p<0.005$). The most frequent risk factors were age, family history of SCD and/or cardiovascular disease and inadequate physical activity; leading conventional risk factor was hypertension. Witnesses of sudden cardiac death were present in 58.0% cases. None of the persons with out-of-hospital SCD received adequate first aid from bystanders.**Conclusion:** Sudden cardiac death is the single most frequent cause of death among inhabitants of Živinice municipality; proportion of SCD within all other causes of death was 22.3%. Incidence of SCD however, is not significantly higher when compared to industrialized countries. A risk for sudden cardiac death is significantly higher and directly depends on the presence and number of risk factors.**Keywords:** sudden cardiac death, incidence, risk factors

INTRODUCTION

Sudden cardiac death (SCD) is an unexpected natural death due to cardiac causes in a short time period, generally within one hour of the onset of acute symptoms. Pre-existing heart disease may be present, but the time and the mode of death are unexpected.^{1,2} SCD is the single most important cause of death in the adult population of the industrialized countries with incidence rates in the general population around 1 per 1000 inhabitants per year.¹ The largest increase of risk

from SCD has been reported in middle-aged persons (between 40 and 65) with progressive coronary and other cardiovascular diseases (CVD). Men in age group between 60 and 69 years, with structural heart disease, have an increased risk from SCD which is around 8 per 1000 per year. Fifty percent of all cardiac deaths are SCD.^{3,4} Risk factors contributing to SCD are mainly the same ones as those contributing to atherosclerosis and coronary heart disease (CHD): elderly, male, family history of CHD, high level of LDL cholesterol, low level of HDL cholesterol, hypertension, smoking, diabetes mellitus, obesity and lack of physical activity.² Coronary heart disease is responsible for more than 60% of SCD

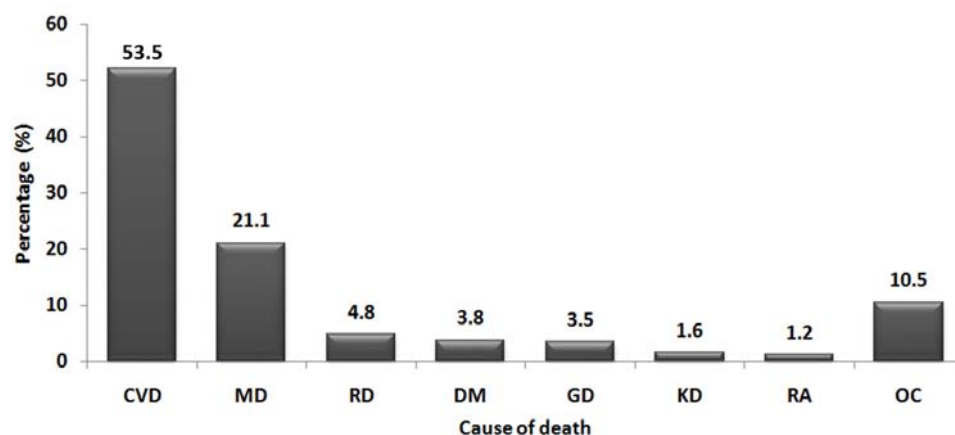


Figure 1. Proportions of causes of death in the region of Živinice municipality during the year 2007

Legend:

CVD – cardiovascular diseases
MD – malignant diseases
RD – respiratory diseases
DM – diabetes mellitus
GD – gastrointestinal diseases
KD – kidney diseases
RA – road accidents
OC – other causes

in adult. SCD occurs in patients with acute or chronic heart disease in about 65% cases. Patients with evidence of pre-existing CHD have 11 times higher mortality than asymptomatic persons.^{3,4} In patients with diabetes mellitus incidence of SCD is higher in females than in males, and SCD is frequently the first and the only symptom of CHD in those patients. Patients with diabetes mellitus have 3 times, those with hypertension 2.5 times and those with obesity 1.6 times higher risk for SCD than persons without any of the afore mentioned risk factors.⁵ In other cases SCD occurred in the absence of CHD and coronary atherosclerosis. However, other conditions are more frequent, such as structural abnormalities of the heart, hereditary and other cardiomyopathies (CMP), inflammatory heart diseases, disturbances of ion-channel (channelopathy), genetic predisposition, intoxication with different substances and SCD provoked with various drugs.^{3,6} Sudden death is the final result of multiple processes which mainly are presented with ventricular fibrillation (VF) or ventricular tachycardia (VT) recorded on electrocardiogram (ECG) as the first rhythm at the time of collapse.^{7,8} The aim of this study was to determine the incidence of SCD in the region of the Živinice municipality in year 2007 and to evaluate the rates of the most frequent risk factors. Until now, there are no reports with the exact data about SCD incidence from any region in Bosnia and Herzegovina.

PATIENTS AND METHODS

In this prospective epidemiological study we recorded all cases of SCD among all cases of death in the region of the Živinice municipality during the 2007 by using the data from death certificates and medical documentation and data received from interviews with physicians who pronounced death, from witnesses and family members. Definition and criteria of SCD by European Society of Cardiologist (ESC) and American Heart Association (AHA) from 2001, and use of International Classification of Diseases – Version 10, were applied to determine the number of SCD.^{1,9} Data for persons who died in the hospital and/or out of territory of the municipal Živinice were retrieved from Institute for Public Health of Tuzla Canton. In persons with SCD we documented known risk factors from their patient records. We also analyzed numbers of witnessed SCD and frequency and quality first aid.

Statistical analysis

We performed basic analysis of data by using standards methods of descriptive statistics. Data was compared by using chi-square test or Students t-test. We tested presence of significant relation between variables by using Pearsons correlation. A 95% level of significance was accepted for all tests.

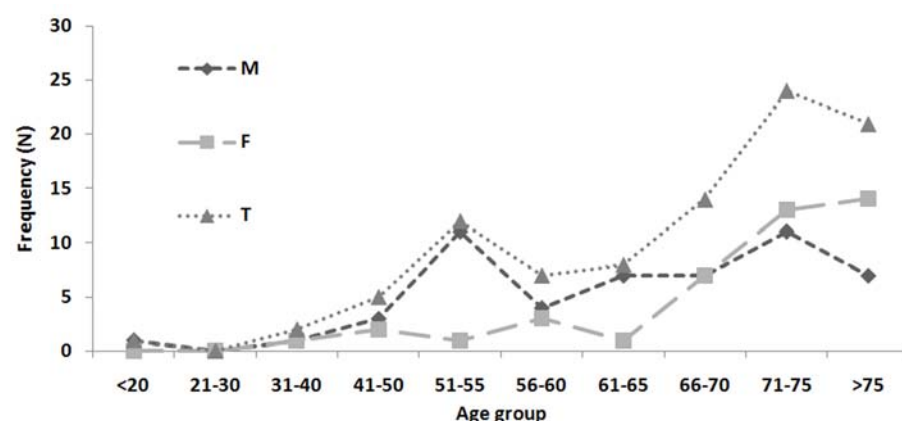


Figure 2. Frequencies of sudden cardiac death according to age and gender

Legend:

M – male
F – female
T – total

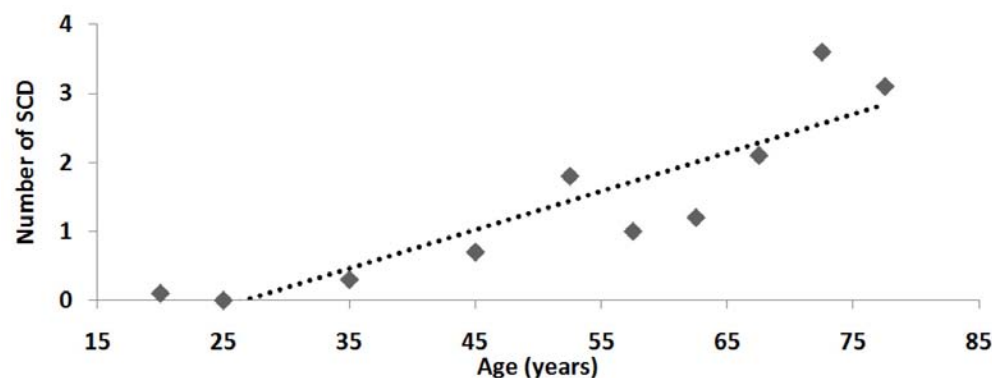


Figure 3. Linear trend of the increase in numbers of sudden cardiac deaths with age. Dotted line represents the trendline.

RESULTS

During the year 2007, there were 421 deaths by different causes in the Živinice municipality. Overall mortality was 6.3 per 1000 inhabitants. Leading causes of mortality were cardiovascular diseases – 225 (53.5%) cases. CHD was cause of death in 105 (46.5%) cases, cerebrovascular accident in 65 (28.8%) cases and other cardiac causes were present in 55 (24.7%) cases. More than one-fifth persons died from malignant - 89 (21.1%). Other causes of death were less frequent (Figure 1).

Number of persons who died from SCD during 2007 was 94 or 22.3% in overall mortality. In this year, SCD was the single most frequent cause of death in population of Živinice municipality with the incidence of 1.4 persons per 1000 inhabitants. We have not found any significant difference in incidence of SCD between the Živinice municipality and other industrialized countries and countries in transition ($p > 0.05$).

According to gender, there were 52 (55.3%) males and 42 (44.7%) females. Average age of persons died from SCD was 66.3 (± 12.6) years; females were in average 70.3 (± 10.3) years old and males were 63.1 (± 11.5) years old.

Table 1. Percentage of risk factors for sudden cardiac death within the study sample

RISK FACTORS	NUMBER	PERCENTAGE
Hypertension	59	62.7 %
Diabetes mellitus	29	30.8 %
Smoking	42	44.7 %
Hyperlipidemia	19	20.2 %
Obesity	55	58.5 %
Known heart disease	43	45.7 %
Family history of SCD and/or CVD	79	84.0 %
Inadequate physical activity	65	69.1 %
Psychosocial factors	40	42.5 %
Age	87	92.5 %
ECG changes	41	43.6 %
Other risk factors	25	26.6 %

In average, men were 7.5 years younger than women at the time of death ($p = 0.25$) – Figure 2.

Among those died from SCD, the ratio between males and females was 1.24:1. Up to age of 55, this ratio is four time higher in males. After the age of 65 women died 1.36 times more frequent than males. In the age group between 66 and 70 years, number of cases of SCD becomes equal between males and females. We have found a significant correlation between age and the number of SCD ($r = 0.89$; $p < 0.005$) - Figure 3.

In 29 (30.8%) persons who died from SCD we did not have any data about their visits to physician or about their medical examinations at any other health centers in last two years. Periodical notification to physician (one to four times per year in last two years) were registered in 36 (38.3%) cases. Only 29 (30.8%) persons were on regular follow-up by physician, at least one time per month in last two years. Known risk factors for SCD registered from patient records are shown in Table 1.

In this table we see that the three most frequent risk factors for SCD were age, family history of SCD and/or CVD and lack of physical activity. Most frequent conventional risk factors in males were smoking, hypertension and diabetes mellitus. Among women the most frequent risk factors were hypertension, diabetes mellitus and high level of serum lipids. The most frequent conventional risk factor in both sexes was hypertension which was registered in 59 (62.5%) persons died from SCD (Figure 4).

Among 225 cases of all out-of-hospital deaths in Živinice municipality, 88 (39.1%) died by type of sudden cardiac death or had an experience of out-of-hospital cardiac arrest (OHCA). Witnesses of SCD were present in 51 (58.0%) cases of cardiac arrest, but not a single person with cardiac arrest and SCD did not receive any form of cardiopulmonary resuscitation (CPR) and first aid from bystanders. Only 6 (6.8%) persons with SCD were transported to stationary Department of Emergency Medical Service (EMS) within the 10 minutes after cardiac arrest. These persons received adequate measures of CPR and advanced cardiac life support (ACLS). In 2 (2.3%) persons with signs of VF and VT on ECG, after defibrillation cardiac

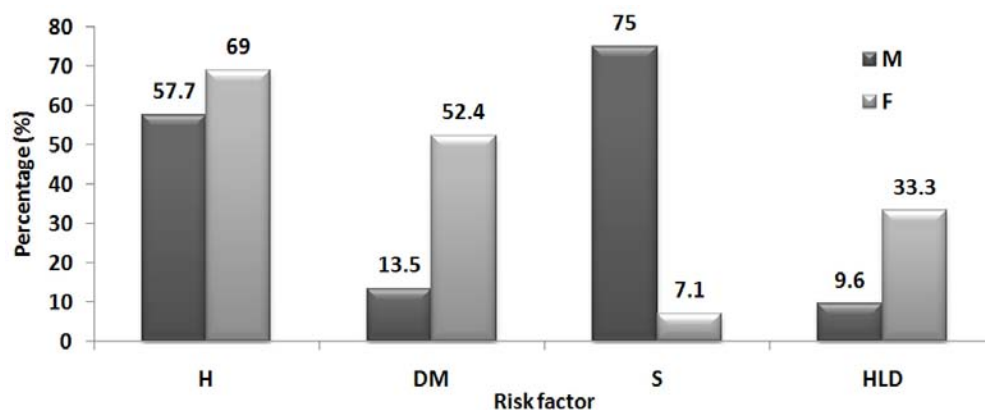


Figure 4. Ratio of presence of conventional risk factors according to gender

Legend:
 H – hypertension
 DM – diabetes mellitus
 S – smoking
 HLD – hyperlipidemia
 M – male
 F – female

rhythm was successfully restored to a life compatible cardiac rhythm. Irrelevant number of persons with SCD received adequate first aid ($p > 0.5$).

DISCUSSION

During the year 2007, a total of 421 deaths was registered in Živinice municipality and 94 of them were classified as SCD. Ratio of SCD in overall mortality was 22.3%, and SCD is the leading cause of death among inhabitants of the Živinice municipality. This in accordance with most reports dealing with SCD which described SCD as the leading cause of death in the world.^{1,2,3,4} Incidence of SCD in general population is 1 per 1000 cases per year in all age groups in the industrialized world and in countries in transition, and ranges between 0.36 to 1.28 per 1000 inhabitants per year.¹ Incidence of SCD in the Živinice municipality during 2007 was 1.4 per 1000 inhabitants. This incidence is somewhat higher than incidence reported by other authors, but was not statistically significant. On the other side, this incidence is significantly (three times) lower than the reported incidence of 4.2/1000 in Mostar, 2003.¹⁰ At the same time, our incidence is significantly higher than the incidence of SCD in Multnomah County, Oregon, in year 2003 which was reported to be at the level of 0.53/1000. Significant differences between two comparing regions may be explained as a result by different ways, methods and approaches to investigations about incidence of SCD. Authors from Oregon reported that the average age of persons who died from SCD was 69 years, and 57,0% of them were male,⁹ and these numbers are similar to those in our study. In our sample, the average age was 66.3 years and 55.3% persons who died from SCD were males. Incidence of SCD increased in higher age groups, with peak in age group between 71 and 75 years, and this is similar to other reports.^{1,3,4} Same authors reported incidence of SCD in United States of 1.08 cases per 1000 inhabitants per year and also a significantly higher ratio of SCD between male and female (3:1) than one found in our investigation (1.24:1).

Our study has shown that risk factors for SCD are very much the same as risk factors for CHD. Coronary heart disease as a leading cause of SCD, most frequently is asymptomatic, so it is not easy to establish the number of persons with advanced disease, as well as unrecognized myocardial infarction in general population.^{1,11} This fact may explain our results that only 45.5% persons had some form of the confirmed heart disease. In 85.5% persons at least one of conventional risk factors for CHD and/or SCD (smoking, diabetes mellitus, hyperlipidemia and/or hypertension) was found, similar to results reported by other authors.^{2,12} Our investigation also showed that in 43.5% cases verified electrocardiography changes (nonspecific change of ST segment and T wave, higher heart rate, atrial fibrillation, long QT interval, Brugada syndrome) and negative psychosocial factors in 42.5% cases also had a role in the ethiology of SCD.¹³ We have no data about how many patients with SCD had a structurally normal heart because autopsy examination was made in only one case of SCD, where the cause of death was myocardial infarction. According to our data, 7 patients were suspected to present with “primary electrical disease” such as long QT syndrome (3 persons) and Brugada syndrome (4 persons).

Although it is evident that fast response to cardiac arrest and immediate CPR and basic life support by witnesses lead to significant increase in survival.^{14,15} During 2007 in the region of the Živinice municipality not a single person who had an OHCA did receive any form of first aid from bystanders. That fact is a consequence of non-existence of any courses in basic life support for inhabitants and members of public services (police, fire brigade, teachers), as well as paramedics and some medical staff. As a result, we have presence of the ignorance and the fear in bystanders. In the stationary Department of EMS Živinice, timely CPR was offered in only 6.8% cases of out-of-hospital cardiac arrests (because of the late arrival time), and this is 10 times less than in the communities with organized EMS and sufficient numbers of mobile EMS teams.⁹ In our study, mobile teams of EMS were not present, the result of which is that an irrelevant num-

ber of persons with out-of-hospital cardiac arrest did receive an adequate first aid.

CONCLUSIONS

Incidence of sudden cardiac death in the region of the Živinice municipality during the year 2007 was 1.4 per 1000 inhabitants in all age groups. Sudden cardiac death was the most frequent single cause of death among inhabitants of the Živinice municipality during 2007, participating by 22.3% among all causes of death. Average age of SCD cases was 66.3 (± 12.6) years and men were in average 7.2 years younger than women.

Witnesses of sudden cardiac death were present in 58.0% cases but they failed to provide first aid to any of the people experiencing out of hospital cardiac arrest.

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