

Sudden Cardiac Death in Young Adults: Population Aspects in Bihor County, Romania

Andreea Camarasan¹, Andrei Pascalau^{1*}, Ovidiu Camarasan², Narcis Vilceanu¹, Camelia Buhas¹, Andrea Pop-Crisan³ and Ovidiu Pop¹

¹Department of Morphological Disciplines, Medicine and Pharmacy Faculty, University of Oradea, Romania

²Prof. Dr. Ioan Pușcaș Hospital Șimleu Silvaniei, Sălaj County, Romania

³Department of Surgical Disciplines, Medicine and Pharmacy Faculty, University of Oradea, Romania

***Corresponding author:** Pascalau Andrei Vasile, Department of Morphological Disciplines, Medicine and Pharmacy Faculty, Piata 1 December Street, Oradea, Bihor County, Romania

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ABSTRACT

Sudden cardiac death in young adults represents a worldwide health risk, sometimes producing deaths within minutes after the onset of the symptoms. The purpose of our study is to establish population aspects of sudden cardiac death in young adults, in Bihor County, Romania, to evaluate concordance and discordance between macroscopic and microscopic aspects of the heart and to offer a possible solution for diagnosing acute cardiovascular pathology. All consecutive cases were collected from Forensic County Bihor, Romania. To confirm the cause of death sample heart fragments were collected from all suspected sudden cardiac death, 40 years old and below adults, who represented the subject of forensic domain. 90% of the subjects included in our study were males, 19% of males having blood alcohol higher than 1 g‰. In 23% cases macroscopic changes susceptible for myocardial infarction, myocardial dystrophy and myocardosclerosis were observed. Coronary atherosclerosis was noticed in 57,5% individuals.

Keywords: Sudden Cardiac Death; Myocardial Sclerosis; Cardiac Arrhythmias; Cardiomyopathy

Introduction

Sudden cardiac death represents a worldwide medical health problem, it's onset appears suddenly, within minutes, maximum one hour from the beginning of the symptoms, in apparently healthy people [1]. Responsible for the occurrence of sudden cardiac deaths are cardiovascular diseases [2]. It may affect all age groups, including children and youth. In children, the major causes of sudden cardiac death are congenital disorders. In young adults, 40 years old and below, the primary cause of sudden cardiac death is an arrhythmia on a structurally normal or pathological heart [1,3]. On a pathological heart, most often are met dilated cardiomyopathy, hypertrophic cardiomyopathy. On a normal structurally heart, diseases like arrhythmogenic cardiomyopathy, genetic disorders and channelopathies (long QT syndrome, short QT syndrome,

Brugada syndrome, and catecholaminergic polymorphic ventricular tachycardia), are diagnosed [2]. Ischemic coronary artery disease is met more frequent in older adults [2]. Ethyl alcohol is considered to be protective for the cardiovascular system when it is ingested in low to moderate levels [4,5], but high alcohol consumption increases the risk for sudden cardiac death [6]. Although sudden cardiac death is suspected in many medico-legal autopsies there are few cases in which both, the heart and coronary arteries, seem normal at the autopsy and also at optic microscopy, in Hematoxylin and Eosin stain. Therefore, to establish the cause of death further investigation need to be done. Sometimes the pathologist cannot prove any macroscopic lesions so a new technique to determine a possible anoxic pathology could be useful. Wilms' Tumor (WT1) suppressor gene was first discovered in renal tubules and is essential in the development of some organs including the heart. At the level of the heart it is normally expressed

in the embryogenesis of epicardium and also in cardiac endothelial cells [7,8]. In adults with normal structurally heart), WT1 gene is low observed in endothelial cells of capillaries and small veins [7]. After myocardial infarction WT1 is re-expressed not only in infarcted endothelial cells and border zone [7] but, as we observed, it is also overexpressed in affected cardiomyocytes.

Material and Methods

We aimed for an analytical, observational, prospective study. We included 40 consecutive cases, collected in a time interval between January 1st, 2018 and June 15th, 2022. All the cases were collected from Forensic County Bihor, Romania. To confirm the cause of death sample heart fragments were collected from all suspected sudden cardiac death, 40 years old and below adults, who represented the subject of medico-legal domain. Were chosen those fragments of the heart with or without macroscopic changes. For each subject included in the study we collected also demographic data as: gender, residence, age, blood alcohol value and the medical background. The numerical and ordinal variables were analyzed using Microsoft Excel 2016, Statistical Package for the Social Sciences (SPSS) 26 and GraphPad Prism 8.0 Software programs. The standard deviation and values were represented in statistical graph charts and tables.

Results

From the total 40 individuals included in the study, 4 (10%) were females, the rest, 36 (90%), being males. For 23 individuals the living environment was the rural place, while 17 of them belonged to urban place. In 17 (43%) cases alcohol consumption was confirmed, 7 people heaving their blood alcohol more than 1g‰, all 7 persons being males, belonging to 36-40 age group. No female was confirmed with blood alcohol.

Macroscopic inclusion and demographic criteria are summarised in (Table 1). At the medico-legal autopsy, from the total of 40 cases, 2 hearts were normally structured, without any macroscopic pathological changes. In other 38 cases macroscopic changes like atherosclerosis, pericarditis, epicardial sclerotic plaques, cardiomegaly, myocardial dystrophy, myocardosclerosis, changes susceptible for myocardial infarction were meet. In 9 (23%) cases macroscopic changes susceptible for myocardial infarction along with myocardial dystrophy and myocardosclerosis were observed (Figure 1). 17 (42,5%) cases associated also cardiomegaly; concentric and excentric hypertrophic cardiomyopathy was observed in 5 (12,5%) cases, pericarditis in 2 cases. Coronary atherosclerosis was noticed in 23 (57,5%) individuals, all individuals situated in 36-40 age group, Pearson's correlation coefficient (0.57) determining a strong correlation between age and coronary atherosclerosis.

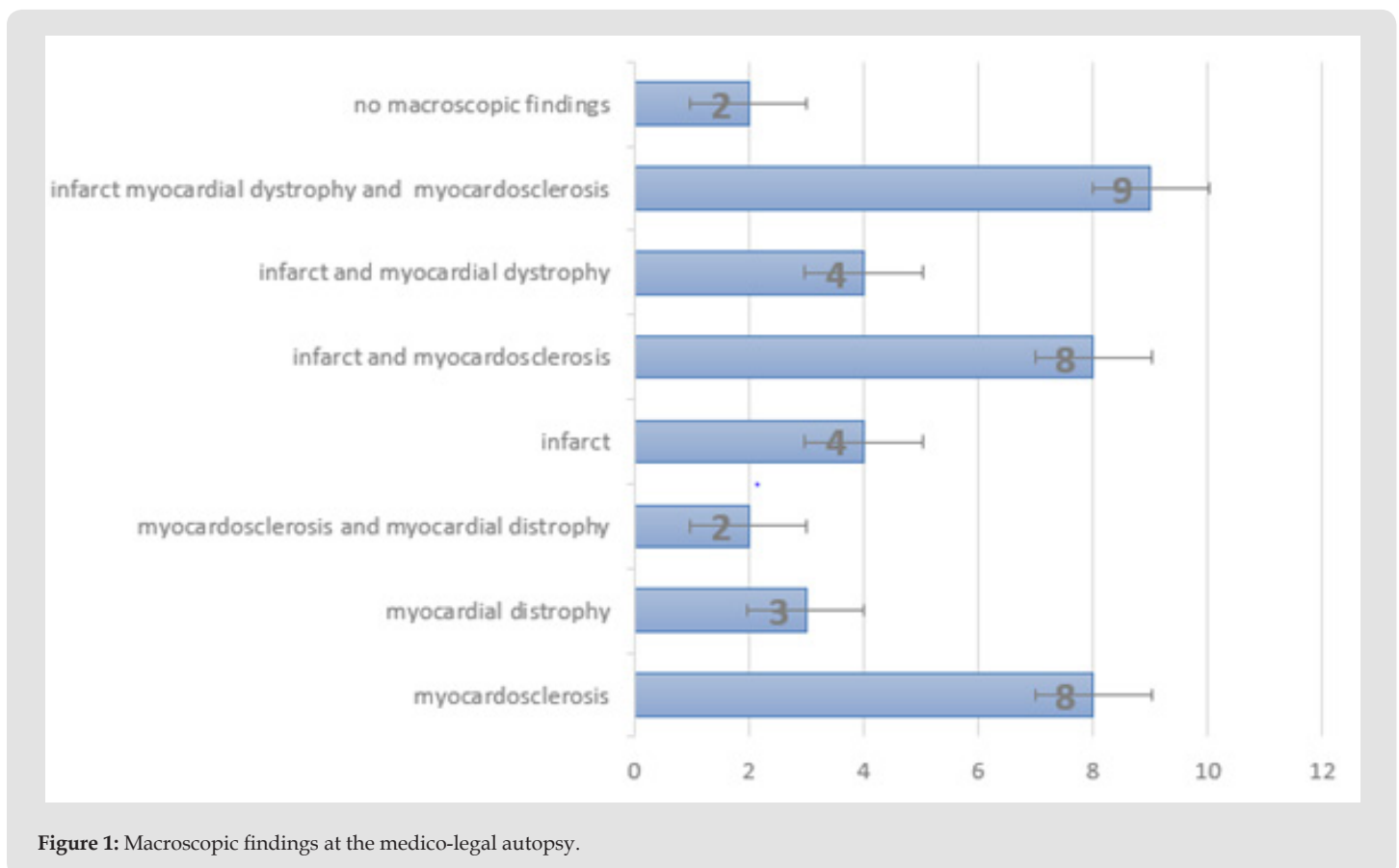


Figure 1: Macroscopic findings at the medico-legal autopsy.

Table 1: Macroscopic demographic aspects in autopsy.

Sex/cases	Female n/(%)	Male n/(%)
40	4/(10%)	36/(90%)
Residence/cases	Urban n/(%)	Rural n/(%)
	17(42.5%)	23 (57.5%)
Age groups/cases	Concordance	Discordance
18-20 yrs	0	1
20-25 yrs	0	0
26-30 yrs	3	0
31-35 yrs	4	3
36-40 yrs	18	11
Blood alcohol/cases	< 1g‰	>1 g‰
17	10	7
Cardiac disease history/cases	Yes	No
	6(15%)	34(85%)

Discussion

Sudden cardiac death is responsible for 50% of all cardio-vascular deaths and represents 10-15% of all deaths in Western countries [9]. Sudden cardiac deaths in the young is not commonly meet, but if it appears is usually the first symptom of the disease in this age group [10]. The most common causes are cardiomyopathies, myocarditis, arrhythmias like mitral valve prolapse, channelopathies and family disorders [11,12]. Usually, ventricular tachycardia or ventricular fibrillation are the final pathways which lead to sudden cardiac deaths in the young adults [10]. Male are predominately affected [13], according to our study, males are 10 times more affected than women, so we as other studies [14] found a very large gap between man and woman. Young women are usually protected by menstrual status compared with those women find in late postmenopausal years [15]. 36 to 40 years old age, predominately man, were more frequent affected by sudden cardiac death, because the risk of cardiovascular diseases like coronary artery disease [14] increases rapidly with age. Chronic alcohol intake is associated with alcoholic cardiomyopathy [6], a potential trigger for sudden cardiac death. Also, a large amount of alcohol may lead to atrial fibrillation, increased ventricular ectopic activity, and ventricular tachyarrhythmias [16]. In individuals with ischemic heart disease, an acute alcohol consumption may produce electrical instability [16]. Our study showed in 7 cases a quantity of blood alcohol higher than 1g‰, so the high consumption could have been a trigger for sudden cardiac death. At the autopsy, studies have showed that the heart could be structurally modified [12] with fibrosis, hypertrophy of the right and/or left ventricle, myocardial dystrophy, disorders that can be associated with the onset of an arrhythmias [12].

Disorders like pericarditis, epicardium sclerotic plaques, cardiomegaly, myocardial dystrophy, myocardosclerosis and colour

changes of myocardium suggestive for myocardial infarction, were also find in 38 cases of our study. Rarely, the autopsy and the histological exam don't offer any pathological information about the cardiovascular system and for this reason this kind of autopsy, when no cause of death is found, are called white autopsies. WT 1 gene is normally expressed in epicardium, playing an important role in heart developing, in time of embryogenesis. At low levels, up to 25%, WT1 gene may be expressed also in embryonic cardiomyocytes [17]. Studies show [17] that WT1 overexpression, in adults, on a distress myocardium, is present in angiogenesis process in the suffering endothelial cells at the border zone of hypoxia. In young adults, the overexpression of WT1 gene may help the forensic doctor to find out the cause of death in the early hours. When the macroscopic and microscopic changes are not seen, overexpression of WT1 gene ensure us that an acute cardiac process, with the onset lower than 48 h, was taking place when the death occurred. In medico-legal medicine, death which is taking place shortly after an acute myocardial infarction, raises diagnostic problems and the cause of death is missed, therefore using WT1 immunomarker, the acute suffering of the heart is diagnosed, so the cause of death may be established.

Conclusion

In Bihor County, Romania, sudden cardiac death in young adults is 10 time more frequently meet in man, affecting predominately the 36-40 age group. Individuals without any macroscopic and microscopic cardio-vascular alteration may be affected by sudden cardiac death. In front of such cases, the forensic doctor may not be able to establish the cause of death. Therefore, in these situations, for diagnosing the cause of death, WT1 immunomarker needs to be taken in consideration as an additional test. Overexpression of WT1 gene, in the nuclei of affected myocytes, in a normal macroscopic and microscopic heart, may offer additional information, diagnosing an acute suffering of the heart, and affirming a potential cause of death.

Conflict of Interest

The authors declare that there is no conflict of interest.

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Pascalau Andrei Vasile. Biomed J Sci & Tech Res



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