Studia Universitatis "Vasile Goldiş", Seria Ştiinţele Vieţii
Vol. 20, issue 2, 2010, pp. 17-20
© 2010 Vasile Goldis University Press (www.studiauniversitatis.ro)

CASE STUDY ON SUDDEN CARDIAC DEATH

Ovidiu BULZAN[1], George Ciprian PRIBAC[2]
[1] County Emergency Clinic Hospital Arad, Department of Forensic Medicine
[2]"Vasile Goldis" Western University Arad, Department of Cell and Molecular Biology

ABSTRACT. Sudden cardiac death occurs, according to WHO within an hour after the onset of the first symptoms. According to the recommendations of the European Society of Cardiology, sudden cardiac death is defined as, "natural death due to cardiac causes, announced by the sudden loss of consciousness within one hour after the debut of acute symptomatology; the pre-existing heart disease may be known but when and how death appears is unexpected. The study aims to find correlations between data history, age, sex, macroscopic diagnosis and anatomical substrate (materialized by microscopic histological examination, following that in the next steps of the experiment to complete our research with molecular investigations on archived histological samples). Of the 22 autopsies, the case of a man of 40 years, draw our attention, a man who died at home with witnesses, in the absence of premonitory symptoms or paraclinical elements and whose health status was regularly checked by the nature of his job. Forensic autopsy could not detect certain gross morphological changes in the heart.

Keywords: sudden death, microscopic analysis, molecular analysis

INTRODUCTION

Sudden cardiac death is the subject of extensive scientific studies both in our country and abroad. Although cardiac death is found in younger ages and there is a paucity of the necrotic issues, at present there is insufficient explanation regarding the epidemiological causes, lifestyle, genetics or the morphological real reason.

The term of sudden cardiac death is used for several centuries and during these time, different authors have had controversy over the most appropriate definition.

The Free Dictionary by Farlex defines sudden cardiac death as an unexpected death due to heart problems and which appears within an hour after the onset of cardiac symptoms. After the definition of R.J. Myerburg, the term of sudden cardiac death refers to non-violent natural death, out of cardiac causes, clinically characterized by sudden loss of consciousness consecutive to heart stop in less than an hour after the onset of acute symptoms.

Sudden cardiac death occurs, according to WHO within an hour after the onset of the first symptoms. According to the recommendations of the European Society of Cardiology, sudden cardiac death is defined as, "natural death due to cardiac causes, announced by the sudden loss of consciousness within one hour after the debut of acute symptomatology; the pre-existing heart disease may be known but when and how death appears is unexpected.

The concepts on which the fundamental definition of sudden death relies on are non-traumatic nature of the event and the fact that death must be unexpected and instantaneous. To limit the causes of sudden death for the heart disease there has been introduced the term of 'sudden cardiac death". It was subsequently proposed a subset to distinguish between the 'coronary' and non-coronary death. The time used to describe the event was initially of 24 hours and was later reduced to one hour or even to an instantaneous event, pleading for an arrhythmic mechanism.

It should be emphasized that medical information available for the forensic are often poor and incomplete. So what for a forensic can be a death without symptoms in full health, can actually be a sudden cardiac death announced by some symptoms about which only the deceased or his family were informed but were not considered at their fair value. Therefore, we consider that historical discussions with family or careers are important. Because loss of consciousness occurs in 5-8 seconds after hear stopping, the study of sudden cardiac death is difficult because they deal with people who have died most often without witnesses or witnesses who cannot provide consistent information, and cannot describe what they felt before cardiac stopping.

20% of all deaths in the U.S. are due to sudden cease of the heart. The idea that the pre-lethal state (sudden stopping of the heart) appears out of nothing (coming out-of-the-blue), is most often incorrect, as shown in the Harvard Heart Letter. Clinical studies show that in 90% of the victims have symptoms which last at least 5 minutes and only 10% of the cases truly present unannounced heart failure.

To explain why death occurs suddenly at a certain moment when the adjacent cardiopathy already exists, Stephen Vlay proposes an equation which complements the definition: sudden cardiac death = trigger agent acting against an anatomical reason. The anatomical reason consists of structural and / or electrical abnormalities in relation to an acquired or congenital cardiopathy. The trigger reason may be of a mechanical, metabolic, neurological, ischemic, psychological, etc.

For the elderly, sudden cardiac death is usually the result of ischemic heart disease. There are cases where even after an extensive research (anatomical, including

***Correspondence:** George Pribac, Faculty of Medcine, Pharmacy and Dental Medicine, "Vasile Goldis" Western University Arad, no. 1 Feleacului St., Arad, Romania, E-mail: georgepribac@gmail.com*
Article received: January 2010; published: May 2010

of the excito-conducting tissue, histological, immunohistochemical, molecular) the causal reason is not emphasized.

Unless there is a known preexisting disease or the persons are young people, death is considered unexplained and according to the legal recommendation, forensic autopsy is requested. At the elderly persons we find the ischemic cardiopathy, respectively a coronary thrombosis or infarct. In children or young adults the first cause of sudden cardiac death is cardiomyopathy, then ischemic cardiopathy, valvular disease and the pathology of the cardiac routes. After the classic autopsy on young people there remain between 6-40% of cases where the diagnosis is not established. These deaths are considered secondary to an arrhythmia, which is consecutive to canalopathy with presumed genetic predisposition.

Molecular Autopsy: The term is used in recent years and mean genetic analysis performed on biological material collected postmortem from both cases where macroscopic and microscopic morphological changes incompatible with survival were revealed, especially in autopsy classified as negative or where morphological changes of the heart could not explain the thanatogenerating mechanism.

At Legal Medicine Romande Switzerland, they are investigating the gene mutations SCN5A, KCNQ1 and KCNH2 suspected of canalopaty.

The Legal aspects of genetic analysis applied post mortem: molecular autopsy is a necessary diagnostic means to detect canalopaties and is very useful to confirm hypertrophic cardiomyopathy. In Switzerland it is not necessary the consent of the deceased or his/her relatives to perform forensic autopsy. But for a retrospective analytical study or autopsy the consent is mandatory in order to carry out genetic tests.

In the case of hypertrophic cardiomyopathy we are talking about genetic determinism, with autosomal dominant transmission, the prevalence is of 1 / 500 in the general population. It is the reason of numerous deaths of young people and athletes, and the morphological substrate varies, genetically there is great heterogeneity and about 500 mutations in at least 16 genes.

The canalopaties include cardiomyopathies often genetically determined with autosomal dominant transmission. The frequency of the QT long and Brugada syndrome in the general population is estimated to 1-2/5000.Nearly 10 genes are currently identified in the long QT syndrome: SCN5A, KCNQ1 and KCNH2 in most cases. SCN5A mutations are present in 20% of cases of Brugada syndrome.

The case of sudden death in children is a tragic event and the indication of a forensic autopsy is even more traumatic by police and judicial intervention. In these cases questions are put even after years, when some assumptions can be rephrased such as poisoning or suspected maltreatment. The examinations can evoke an accidental suffocation. A German study shows that for over 83% of the parents, forensic autopsy was a real support during mourning period. In 17% of the cases when parents initially opposed an autopsy later found it useful. Tester and his collaborators have shown that between 5-10% of cases of sudden death in children are the results of the damage sodium made to the channels.

The legal aspects of genetic analysis applied post mortem: molecular autopsy is a diagnosis means required to detect canalopaties and is very useful to confirm hypertrophic cardiomyopathy. In Switzerland the consent of the deceased or his/her relatives is not necessary in order to perform forensic autopsy. But for a retrospective analytical study or for autopsy the consent is mandatory to carry out genetic tests.

Nowadays, when a young dies, the diagnosis algorithm should take into account with priority the toxicological analysis to determine the presence or absence of narcotics. In the case of a negative toxicology result and of a necrotic paucity death from cardiac specified or unspecified etiology can be taken into account.

Van T.B. Nguyen-Tran, University of California, San Diego (UCSD) Institute of Molecular Medicine, 2000 demonstrates the genetic defects that generate pathological ways that can cause ventricular arrhythmia and sudden death in mice. The study shows for the first time that sudden cardiac death may involve pathways that control the formation of into the heart of pacemaker cells that can be compared to electrodes controlling heart rate.

Recently it was shown that myocardial remodeling, of the extracellular matrix and subsequent fibrosis are involved in the pathogenesis of cardiac arrhythmia by correlations between myocardic fibrosis, the pressural loading, the inflammation and the incidence of ventricular tachycardia.

The study aims to find correlations between data history, age, sex, macroscopic diagnosis and anatomical substrate (materialized by microscopic histological examination, following that in the next steps of the experiment to complete our research with molecular investigations on archived histological samples).

MATERIALS AND METHODS

We have studied the histopathological preparations obtained from 320 autopsies found within the county Forensic Medicine Service in Arad for 2009. Of these we have selected 22 cases in which the deceased were aged up to 46 years and the microscopic examination revealed clear morphological damage to the heart. Microscopic histopathological analysis was performed on tissue fixed in 10% formalin and sections included in paraffin for histopathological standard H&E staining.

© 2010 Vasile Goldis University Press (www.studiauniversitatis.ro)

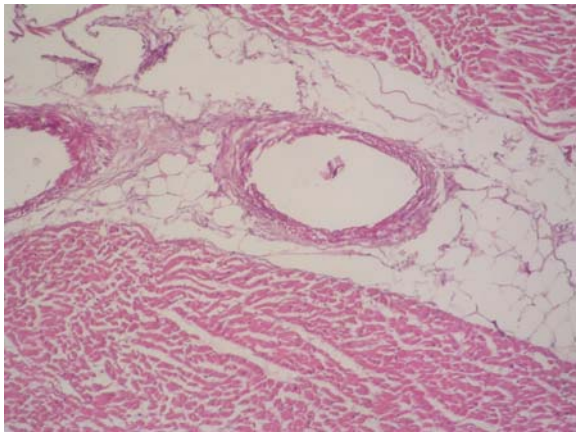

Fig. 1 Small foci of myocardial lipomatosis, HE, 10X

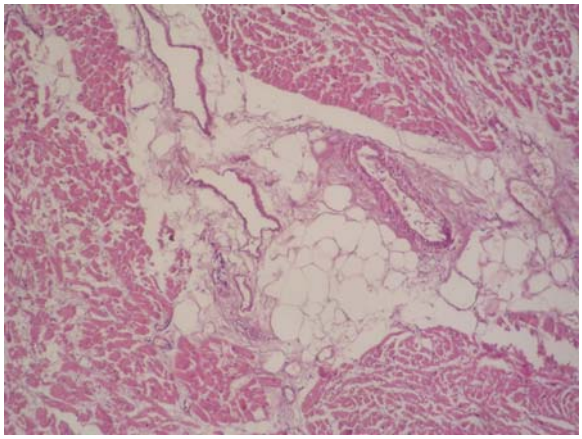

Fig. 2 Small foci of myocardial lipomatosis, HE, 10X

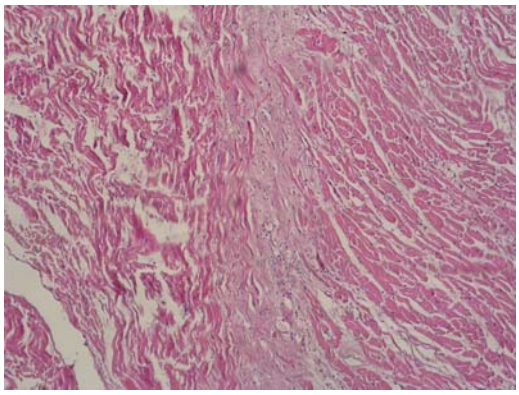

Fig. 3 Small focus of myocardial infarct with thinned cardiac myocytes, some fragmented, with intense eosinophilic sarcoplasma, homogeneous, with diminished striations and with pycnotic or disappeared nuclei, sketch fibril eosinophilic network with a few fibrocytes and fibroblasts, a few vessels of small diameter with thin walls and moderate infiltrate consisting of lymphocytes, macrophages and some granulocytes, H&E, 10X

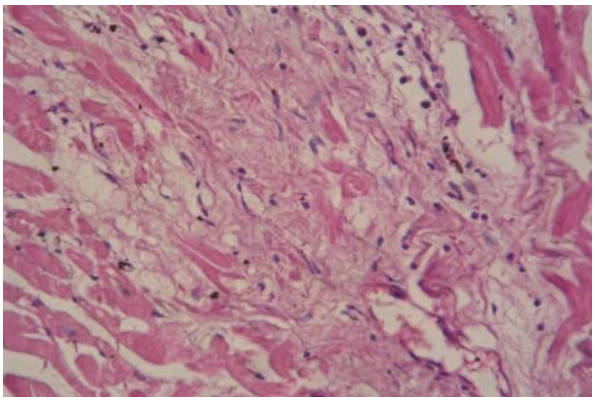

Fig. 4 Small focus of myocardial infarct with sketch tissue of granulation, HE, 20X

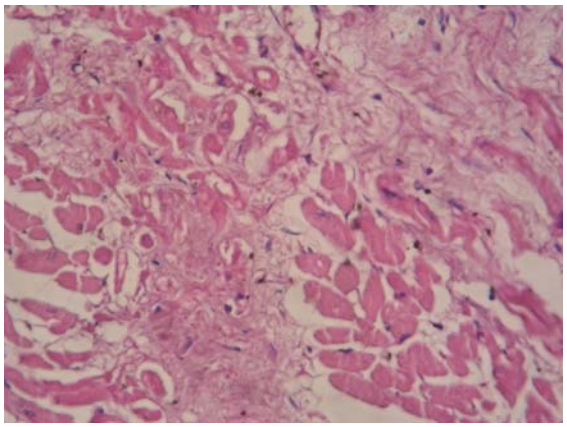

Fig. 5 Small focus of myocardial infarct with sketch of tissue of granulation, HE, 20X

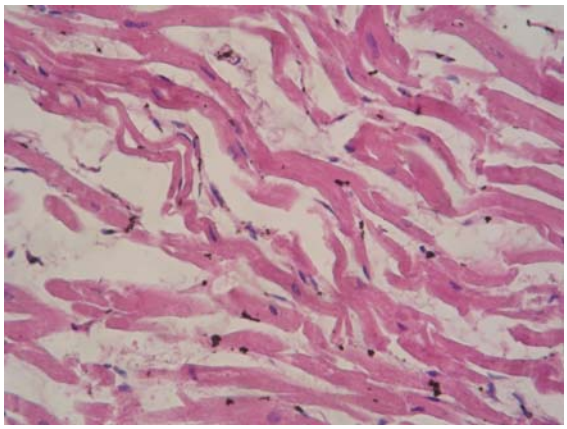

Fig. 6 Cardiac myocytes with aspect of “corrugated fibers”, HE, 40X

© 2010 Vasile Goldis University Press (www.studiauniversitatis.ro)

Of the 22 autopsies, the case of a man of 40 years, draw our attention, a man who died at home with witnesses, in the absence of premonitory symptoms or paraclinical elements and whose health status was regularly checked by the nature of his job. Forensic autopsy could not detect certain gross morphological changes in the heart.

The histopathological elements of microscopic diagnosis that we've tracked were: coronary atherosclerosis, myocardial infarction, myocardial fibrosis, myocardial lipomatosis and myocarditis.

RESULTS AND DISCUSSIONS

Of the 22 cases studied, 20 (90.90%) were male and two were female (9.09%) with a ratio B:F = 10:1, with the average age of about 38 years. Coronary atherosclerosis was found in 3 cases, myocardial infarction in 9 cases, 8 cases of acute myocarditis and myocardial fibrosis (with degrees of mild, moderate and severe) was found in 10 cases. In four cases, macroscopic examination could not detect certain gross morphological changes in the heart: in two cases, the diagnosis of death involves a violent death (the action of traumatic factors) and the other two cases of death by infectious substance (bronchopneumonia and interstitial pneumonia with meningitis).

There was a positive correlation between macroscopic and microscopic observations on coronary atherosclerosis and myocardial fibrosis. The case of the man of 40 years is an example in which the microscopic histopathological examination revealed cardiac lesions that could not be detected macroscopically.

CONCLUSIONS

Sudden cardiac death may be the first symptom of a lethal disease to young persons and children.

Many cardiac diseases located at the origin of sudden cardiac death are genetically determined and have a different anatomical reason.

The anatomic-pathologic microscopic examination is essential for determining the cause of death in cases of sudden death with cardiac etiology.

The possibility of performing genetic analysis on archived biological samples in the near future will establish a correspondence between genetic predisposition and various types of anatomical reasons in cases of sudden death.

REFERENCES

Shaper AG, Wannamethee G, Macfarlane PW, Walker M. Heart rate, ischaemic heart disease, and sudden cardiac death in middle-aged British men. Br Heart J 1993; 70: 49-55. Eur heart J. Vol 22, issue 16, August 2001.

Haider AW, Larson MG, Benjamin EJ, Levy D. Increased left ventricular mass and hypertrophy are associated with increased risck for dudden death. J Am Coll Cardiol 1998; 32: 1454-9.

Kors JA, de Bruyne MC, Hoes Awet al. T-loop morphology as a marker of cardiac events in the ederly. J Electrocardiol 1998; 31(Suppl): 54-9.

Burton F, Cobbe SM. Dispersion of ventricular repolarization and refractoriness. Cardiovas Res 2001; 50: 10-23.

Elliot PM, Poloniecki J, Dickie S et al. Sudden death in hypertrophic cardiomyopathy: identification of high risk patients. J Am Coll Cardiol 2000; 36: 2212-6.Berger R.: Circulation. 2002; 105: 2392-2397.

Veinot JP, Gattinger DA, Fliss H.: Early apoptosis in human myocardial infarcts. Hum Pathol 28(4): 485-492(1997).

Sholler GF, Walsh EP. Congenital complete hearth block in patients without anatomic cardiac defects. Am Hearth J 1989; 118: 1193-8.

Maron BJ. Sudden death in young athletes. Lesson from the Hank Gathers a. air. N Engl J Med 1993; 329: 55-7.

Maron BJ. Cardiovascular risks to young person on the athletic field. Ann Intern Med 1998; 129: 378-86.

Beranek JT: Pathogenesis of hearth fibrosis in systemic sclerosis. Int J Cardiol 2001, 80: 261-262.

Blagy H, et al: Serum BNP, hs-C-reactive protein, procollagen to assess the risk of ventricular tachycardia in ICD recipients after myocardial infarction, Europace.2007 Sep; 9(9): 724-9.Epub 2007 May 24.

Narula, J et al.: Apoptosis in myocytes in end-stages heart failure, N Engl J Med 335(16): 1182-1189(1997).

Pfister GC, Pu.er JC, Maron BJ. Preparticipation cardiovascular screening for collegiate student-athletes. JAMA 2000; 283: 1597-9.

Dermengiu D., Ceusu M., Rusu M.C., S. Dermengiu., Curcă G.C., Hostiuc S. Sudden death assdociated with borderline Hypertrophic cardiomiopathy and multiple coronary anomalies. Case report and literature review, RJLM vol. XVIII, nr. 1, march 2010, pg. 3-13.

Michaud K., Lesta M.D.M., Fellman F., Mangin P., L'autopsie moleculaire de la mort subite cardiaque : de la salle d'autopsie au cabinet du praticien, Revue Medicale Suisse, 2 juillet 2008, no 164, vol 4, 1585-1632, ISSN 1660-9379.

Beranek JT: Why primary angioplasty is less offensive to the myocardium compared with thrombolysis for acute myocardial infarction. Am heart J 2000.

Myerburg, Robert J. „Cardiac Arrest and Sudden Cardiac Death" in Heart Disease: A Textbook of Cardiovascular Medicine, 7 thedition. Philadelphia: WB Saunders, 2005.

Dermengiu Dan. Curs de medicină legală. Editura Viaţa Medicală Românească, Bucureşti 2005, 26-53.

Curcă GC, Drugescu N., Ardeleanu C., Ceauşu M.: Repere de investigare în moartea subită cardiacă la adultul tânăr, Rom J LegMed 16(1)57, 2008, 57-66.

Robert J Myerburg, Agustin Castellanos: Cardiac Arrest and Suden Cardiac Death: 26; 890-909. 2001.

© 2010 Vasile Goldis University Press (www.studiauniversitatis.ro)