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Sudden Cardiac Death in Medico-Legal Casuistry

Death, the only fair injustice. Sudden cardiac death (SCD) from a forensic perspective, represents the most common manifestation of a previously unknown cardio-coronary pathology. It often affects seemingly healthy individuals in the active population, posing a major public health problem and generating concerns in fields such as emergency units, cardiology, cardiovascular surgery, and forensic medicine. It is considered a suspicious death in justice, marked by the sudden and unexpected demise of a seemingly healthy person.

This thesis emphasizes the etiopathogenic complexity of SCD, highlighting risk factors such as advanced age, male gender, family history of cardiac diseases, elevated LDL cholesterol levels, diabetes mellitus, hypertension, and other factors. The use of internal cardiac defibrillators and medical therapies, such as beta-blockers, has reduced cardiac mortality among individuals in risk categories, paradoxically increasing the incidence of cases without personal cardiovascular history.

The thesis focuses on the importance of epicardial adipose tissue (EAT) in the context of SCD from a forensic perspective, emphasizing its direct connection to the increased risk of coronary atherosclerosis or cardiomyopathies. EAT is portrayed as a true window of the cardiovascular status. The proposal is that macroscopic and histopathological evaluation of myocardial and epicardial adipose infiltrates could contribute to a better understanding of SCD pathophysiology and suggest the development of new screening protocols to reduce incidence, especially among relatives.

A significant change in recent years is the increased percentage of SCD among individuals epidemiologically classified as having low cardio-coronary risk. The absence of screening and implementation of specific therapeutic measures in this group has led to higher mortality than those considered at high risk. This finding has become a new epidemiological problem, prompting the discovery of new risk factors that could be detected mainly through imaging methods, with the second step being the implementation of screening procedures.

From the first study, we proposed a standardized protocol for medico-legal necropsy examination of SCD cases, successfully used internationally over the last two decades. Male gender, urban environment, and the 40-69 age group showed the highest incidence of the presented casuistry. 61.4% of cases detected as SCD occurred at home in the absence of witnesses, with individuals seen in apparent good health at most one day before death, falling into the second definition of SCD. We demonstrated that age over 55 (OR: 2.53; $p = 0.045$), atheromatous plaque type Vb (OR: 17.19; $p < 0.001$), mild valves atherosclerosis (OR: 4.88; $p = 0.002$), moderate left ventricular dilation (OR: 16.71; $p = 0.008$) act as predictors of SCD. In about 80% of SCD cases aged over 35, we detected the presence of coronary atherosclerosis in various degrees, undiagnosed before death.

We showed that the absence of coronary (OR: 0.06; $p = 0.01$) or valvular (OR: 0.13; $p < 0.001$) atheromatous lesions, as well as the absence of dilated cardiomyopathy (OR: 0.19; $p < 0.001$), act as protective factors against SCD. An increase in EAT thickness can be considered a risk factor for the occurrence of SCD, with high values of EAT ADA (OR: 21.07; $p < 0.001$), EAT Cx (OR: 23.72; $p < 0.001$)

along with BMI (OR: 4.05; p = 0.004) and heart weight (OR: 5.47; p < 0.001) representing strong predictors of this casuistry.

We were able to confirm the conclusions of studies on living individuals regarding the active endocrine and paracrine role of adipokines that directly influence inflammation, atherosclerosis, BMI, and cardiac function, triggering cardiovascular pathology responsible for SCD. In perspective, an increase in BMI would place a person in the SCD risk group, necessitating imaging measurements of EAT thickness at the Cx and ADA levels. An increase in thickness would make the person a candidate for echocardiography and coronary angiography with the establishment of a prophylactic course (medication, interventional, lifestyle modification).

In the second study, we focused on silent myocardial infarction (SMI), often ignored due to nonspecific, mild, or nonexistent symptoms, with an incidence underestimated at the population level, only detected during medico-legal autopsy, whether related causally to the person's death or not.

Our research aligned with international studies, stating that silent myocardial infarction exponentially increases the risk of SCD, with higher prevalence in males and increasing with age. In the multivariate analysis, atheromatous plaque type V in both coronaries (OR: 2.02, p = 0.02; and OR: 2.36, p = 0.01), grade VI atheromatous plaque for the right coronary artery (OR: 2.75, p = 0.03) were independent predictors of silent MI. Other predictors included moderate and severe valvular atherosclerosis (OR: 3.36 and OR: 5.92, p = 0.002 and p = 0.03), severe left ventricular dilation (OR: 2.17, p = 0.04), heart weight (OR: 3.64, p <0.001), EAT Cx (OR: 7.35, p <0.001), EAT ADA (OR: 7.50, p <0.001), thickness of the left ventricular wall (OR: 3.49, p = 0.01), interventricular septum (OR: 3.90, p = 0.007), and lastly, BMI (OR: 3.07, p <0.001).

The third study focused on spontaneous coronary artery dissection (SCAD), a rare cause of SCD, with a debated etiology that alerts the judicial system due to the involvement of both the mother and the fetus. The main risk factors are advanced maternal age, untreated chronic hypertension, gestational hypertension (with a 3x increased risk of myocardial infarction), dyslipidemia, and preeclampsia, with discussions about the use of oral contraceptives and infertility treatments. SCAD presents a high rate of underdiagnosis or misdiagnosis (over 70%), being treated as an acute coronary syndrome. Diffuse obstruction, narrowed lumen, or the presence of an intramural hematoma observed during coronary angiography can easily be confused with the classic atherosclerotic obstruction image, with stenting even increasing the risk of SCD.

All three studies undertaken had a common objective: the relationship between EAT and cardiovascular pathology, through the manifested endocrine and paracrine role, its intimate relationship with coronary arteries and myocardial muscle directly influencing inflammation at these levels, atherogenesis, and myocardial function. The key to studying EAT in the context of SCD is its dependent and directly proportional relationship with BMI, a manipulable factor that could decrease the instituted cardiovascular disease risk by reducing coronary inflammatory load.