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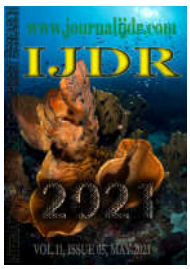

RESEARCH ARTICLE OPEN ACCESS

EPIDEMIOLOGICAL ANALYSIS OF SUDDEN CARDIAC DEATH IN BRAZIL- 2014 to 2019

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ABSTRACT

***Objective*:** To analyze sudden cardiac death (SCD) in the metropolitan region of Goiâniaand its main risk factors. ***Methods*:** This was an observational, cross-sectional, analytical study,in accordance withthe *STROBE Statement* and a retrospective review of 16,018 autopsy reports obtained between 2014 and 2019.The description of 2,141 cases of SCD included the corresponding specific cause of death, demographic characteristics, comorbidities, date, place and time of the fatal event, andthe cardiopulmonary resuscitation (CPR) maneuvers performed. ***Results*:** Male patientsbetween the sixth and seventh decades of life were the most affected. Systemic arterial hypertension (SAH) was more prevalent (66.9%). The patient's residence was the most common place of the fatal event, occurring especially in the morning. CPR was performed in 41.1% of cases, with less recurrence in households (32.32%). Chagas disease (CD) was diagnosed in 246 patients (11.5%). ***Conclusion*:** A significant incidence of risk factors related to coronary artery disease and CD was observed, inaddition toan important variationin the years evaluated.

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INTRODUCTION

Sudden cardiac death (SCD) is defined by the World Health Organization (WHO) as unexpected death resulting from a cardiovascular cause in a person with or without heart disease, which occurs within 1 hour of the onset of symptoms when death is witnessed and within 24 hours prior to the event in unwitnessed death of a victim previously seen in good health (Deo, 2012; Osman, 2015; WHO, 1985). The incidence of SCD in the USA is around 350,000 cases annually, representing approximately 13.5% of the causes of mortalityin the country (McNally, 2011; Muller, 2006). In the recent decades, the incidence of SCD has decreased in parallel with the decline in mortality from coronary artery disease (CAD). CAD is considered as the primary etiologic cause of SCD and is correlated in up to80% of cases (Brouillette, 2019). This change is associated with improvements in primary and secondary prevention of CAD and in the advancement of techniques related to the acute treatment of the disease. Early identification of the more infrequent causes of SCD is observed and these include dilated cardiomyopathy, hypertrophic cardiomyopathy, right ventricle arrhythmogenic cardiomyopathy, and primary electrical disorders (Brouillette, 2019). In 50% of the cases, SCD is the first clinical manifestation of a cardiovascular disease (Hua, 2009). The risk factors such as old age, smoking, male sex, diabetes mellitus, hypercholesterolemia, obesity, and family history of AD have been associated with an increased risk for SCD (Osman, 2015). A recent study in Circulation probedwhether or not, in reality, the causes of sudden death would be different. This study recruited information on allextra-hospital deaths withthe cause of death presumed to be unknown in the municipality of San Francisco, California, USA, from 2011 to 2014. Necropsy was performed to determine the cause of death. The main results of the study stated that 56% of sudden deaths were caused by arrhythmias in cardiac patients and 40% were caused by non-cardiac etiologies. In 50% of the patients, death was the first manifestation of their heart disease. The most common underlying diseases include coronary heart disease (58%), overdose (34%), cardiomyopathy (18%), idiopathic dilated and hypertrophic heart disease (15%), neurological disease (14%), ischemic stroke, cerebral hemorrhage, and epilepsy. The proposed study is of paramount importance for the strategies forprimary and secondary prevention of new events, reducing the secondary problems that may occur, enabling the establishment of public health policies aimed at reducing risk factors, and prompt care of cases (Deo, 2012; Straus, 2006). Thus, our study aimed to trace the epidemiological profile of SCDs in the metropolitan region of Goiânia by analyzing

the main risk factors for CAD and Chagas disease (CD). In addition to correlating the sites of occurrence with cardiopulmonary resuscitation (CPR) maneuvers.

MATERIALS AND METHODS

This was an observational, analytical, and cross-sectional study. Analysis was conducted for therequest forms and complete autopsy reports performed at the Death Verification Service (SVO) for thefatalitiesreferred to this institution in Goiânia from January 2014 to December 2019. The study was approved by the Ethics and Research Committee of the Pontifical Catholic University of Goiás (PUC-GO), opinion 1,679,017, and by the Health Secretariat of Goiânia through the Municipal School of Health. The SVO is the institutionresponsible for the necropsies of the fatalities from nonviolent causes referred by any health service in the city at the request of the physician responsible for the assistance of the deador those not assisted by a specific professional. The inclusion criteria included the fatality reports that were in accordance with the definition of SCD by the WHO (unexpected death within 1 hour of the onset of symptoms or in the 24 hours prior to the event in case of unwitnessed death of a victim previously in good health) and an age over 10 years. The exclusion criteria included the deaths of newborns and children (under 10 years of age), deaths not compatible with SCD (infectious diseases, advanced malignancies, severe abdominal diseases), and fatalities due to sudden death of non-cardiac origin (pulmonary thromboembolism, acute aortic syndromes, asthma, and hemorrhagic stroke). In addition, victims with illegible medical recordsand had incomplete information were excluded from the study.

Initially, all deaths classified by the SVO with Sudden Death (16,018) were separated and evaluated according to the description of the cause of death, from the separate analysis of two researchers. Corresponding, if there is a disagreement between the findings, a third researcher reevaluated the data in an attempt to increase the specificity of the selected cases and decrease the possibility of bias. In this study, 2,141 medical records related to cardiovascular diseases were analyzed. The data collected included the demographic characteristics, date, time and place of the event, and comorbidities of the victims. Of these, personal history of systemic arterial hypertension, diabetes mellitus, dyslipidemia, CD, and smoking were recorded. Moreover, it was verified whether cardiopulmonary resuscitation maneuvers were performed. The data was tabulated and maneuveredusing the Microsoft Excel software®. The distribution of normality of the data was verified by means of a normality test. A comparative analysis between the means was performed using parametric or nonparametric tests. Categorical variables were compared by the Pearson's chi-square test using the Epiinfo 7 software®. Continuous quantitative variables were compared by the Z using BioEstat 5.3®. Statistical significance was set at $p< 0.05$.

RESULTS

In total, 2,141 patients were analyzed, of which 1,296 (60.5%) were males and 845 (39.5%) were female. The age group categories were divided into intervals of ten years, from 10 years to 89 years and older than 90 years. The highest percentage of SCD was concentrated in the 60-69 age group (25.9%), followed by the 70-79 age group (22.7%) ,and then the 50-59 age group(18.7%). The minimum age was 14 yearsand the maximum age was 106 years. The mean and median were 66.1 and 67.0 years, respectively, with a standard deviation of 14.6. Regarding risk factors, 1432 (66.9%) patients had systemic arterial hypertension (SAH), 537 (25.1%) patients had diabetes mellitus, 794 (37.1%) patients were smokers, 246 (11.5%) patientswere diagnosed with CD, and 299 (14%) patients had dyslipidemia. In addition, 878 (41.1%) patients underwent CPR. The location of the fatal event due to SCD was also analyzed. The locations are divided into five groups: the first group includes 1578 (73.9%) deaths which correspond to home level with inclusion of shelters, homes, hotels, and other residences. The second group includes 150 (7.1) deaths which corresponds to the public road with inclusion of bars, streets, or other public roads. The third group includes 326 (15.2%) deaths which corresponds to hospitals and emergency rooms with inclusion of the CAIS (Integrated Health Care Center), CIAMS (Centers for Integrated Medical and Sanitary Care),Hospitals, Family Health Program (FHP), Basic Health Unit (UBS), Emergency Care Units (UPA), and other Health Units in general. The fourth group includes 55 (2.6%) deaths which corresponds to workplaces or studies with inclusion of the places related to efforts, events, and other locations. The last group includes 26 (1.2%) deaths which corresponds to the places intended for sports activities. Correlations were made between the place of death and the performance or non-performance of cardiopulmonary resuscitation, and between risk factors and place of death, risk factors and time of death, risk factors and gender, and risk factors and age. It was in the hospitals and emergency rooms where CPR was mostly performed with a frequency of 70.5%, followed by places intended for sports activities with a frequency of 69.2%. Moreover, the public road had a CPR frequency of 59.33% and followed by workplaces/schools (with a frequency of 52.7%), and then at homewith a frequency of 32.3%. When analyzing the distribution of the frequency of deaths in relation to the period of registration of the event (Figure 1), a significant p-value was observed only in the CPR risk factor ($p<0.001$), and the periods presented, respectively, the following frequency of deaths: 35.4%, 42.9%, and 46.4%. SAH ($p= 0.194$) had a death frequency of 69.2% in the morning, 65.3% in the ending afternoon, and 65.5% at night. DM ($p=0.469$) is associated with a death frequency of 25.9% in the morning, 23.2% in the evening, and 25.7% at night.

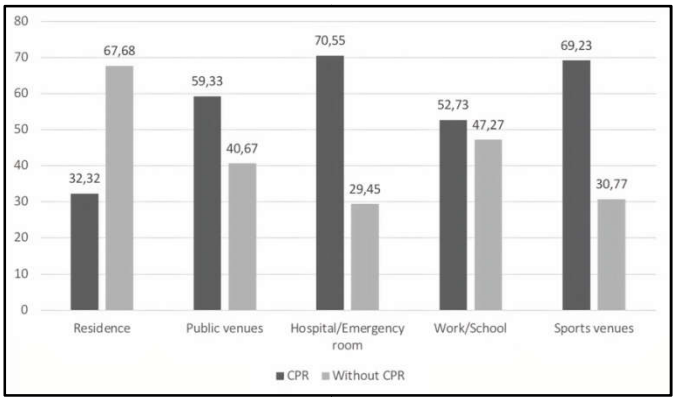

Figure 1. CPR variable distribution according to the place of death

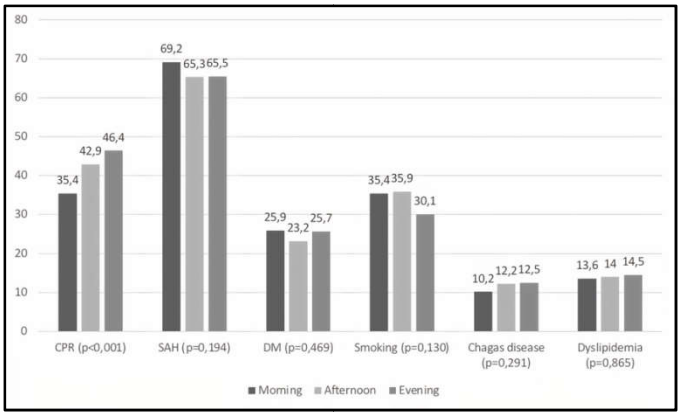

Figure 2. Distribution of the frequency of deaths according to the event registration period

Smoking (p-value=0.13) had a death frequency of 35.4%in the morning, 35.9% in the evening, and 40.1% at night. CD (p=0.291)had a death frequency of 10.2% in the morning, 12.2% in the evening, and 12.5% at night , observed to have lower associations when compared to other risk factors.. Dyslipidemia (p=0.865) had a death frequency of 13.6% in the morning, 14.0% in the evening, and 14.5% at night. In relation to the distribution of the frequency of risk factors in relation

to sex (Figure 2|), , the female sex was associated with a higher frequency of SAH, DM, Chagas disease, and dyslipidemia. CPR (p=0.156)had a higher frequency in males (42.3%) than in females (39.2%). SAH (p<0.001) had a death frequency of 75.3% in females and 61.5% in males. DM (p<0.001) had a death frequency of 30.9% in females and 21.3% in males. Smoking (p<0.001)which were observed significantly more in males had a death frequency of 44.0% and only 26.5% in females.CD showed the lowest frequency in both sexes, with a death frequency of 12.3% in females and 11% in males.In addition, Chagas disease did not show any significant difference (p=0.338). Finally, dyslipidemia (p=0.001) had a death frequency of 17.2% in females and 11.9% in males. A variation of up to 17.4% (2016–2017) was observed with the consecutive analysis of 5 years in the metropolitan region of Goiânia (Figure 3 and 4).

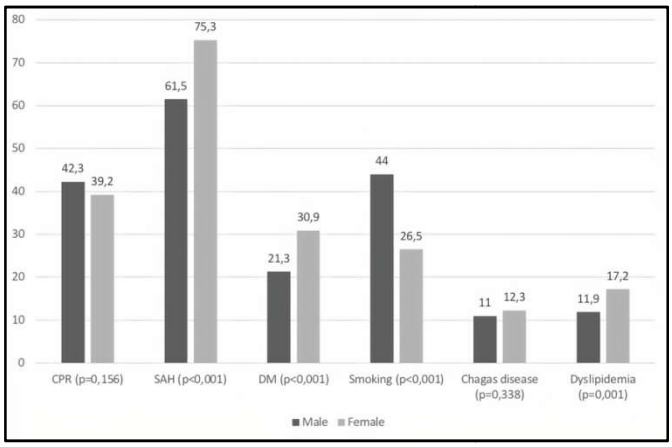

Figure 3. Distribution of the frequency of risk factors according to gender

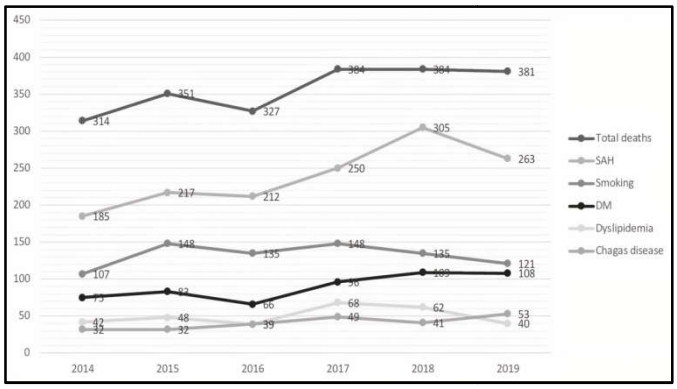

Figure 4. Deaths due to risk factors according to the year

Among the cases of SCD, there was a significant increase in cases of SAH by 22.0% (2017-2018), dyslipidemia by74.0% (2016-2017), and CD by29.2% (2018-2019). In terms of the significantdecrease in cases, the total number of deaths was observed to bebelow 6.8% (2015-2016), in SAHby lessthan 13.7% between 2018 and 2019, smoking by 10.3% between 2018 and 2019, and DM by lessthan 20.4% between 2015 and 2016 and less than 16.3% between 2017 and 2018.

DISCUSSION

The present study results show a correlation to international studies that report a predominance of SCD cases in males and older individuals. In this study, a percentage increase in the age group from 60 to 79 years was observed (Deo, 2012; McNally, 2011; Junior, 2017). Regarding the place of death, the household was the most frequent location of SCD cases. A study conducted in Germany showed that 72% of SCDcases reported outside the hospital environment occurred at home, and 33% of these episodes occurred in the absence of any control (Muller, 2006). It is noteworthy that 7.1% of SCDcases occurred in public and 2.6% in workplaces. Immediate defibrillation of an individual who has suffered a sudden cardiac arrest is the most important determinant of survival. For every minute that passes between cardiac arrest and defibrillation, survival decreases from 7% to 10% without CPR, and 3% to 4% with immediate CPR (Gerber, 2006). Study data showed that less than half of the patients (41.1%) were managed with CPR, and in deaths occurring at home, this percentage was reduced to 32.32%. These results are consistent with other studies that mention that few individuals who experience an episode of SCD receive CPR from a spectator of the episode, and this emergent action has a greater tendency to occur more in public than at home (Adabag, 2010). Even with survival rates equal to or less than 10% (Hayashi, 2015), CPR remains a very important maneuver in the approach of a patient who suffered a sudden heart attack. This reinforces the need for prepared CPR care after calls in homes and the need for portable cardio defibrillators in crowded and congested places. In a previous study conducted in the metropolitan region of Goiânia in 2014, 314 cases of SCD were documented, with a higher prevalence in men between the sixth and seventh decades of life. Other statistically relevant risk factors were diabetes mellitus, dyslipidemia, and smoking (Junior, 2017). The presence of risk factors for CAD is related to an increased risk of SCD in the population. Autopsy studies show that approximately 80% of adults who underwent SCD had severe CAD, which justifies the fact that clinical risk factors for SCD are also predictors of mortality related to CAD (Hayashi, 2015). The present study also identified that 11.5% of the individuals had Chagas disease, a percentage similar to the 10.2% observed in a previous study conducted in Goiânia, which shows the presence of comorbidities of Chagas heart diseasedespite the policies of eradication of the pathology proposed in the last decade (Junior, 2017).

In addition, it was observed that 39.9% of the cases of SCD occurred in the morning, compared with 26.8% in the evening, and 33.3% at night, which is in agreement with the studies that demonstrated a correlation between circadian rhythm and the occurrence of SCD, with a peak incidence occurring between 6 and 12 hours. The morning peak of SCD could be associated with excessive activation of the sympathetic nervous system in the morning (Deo, 2012). Approximately 80% of all SCDs occur at home and about 60% are witnessed (Gerber [b], 2006). It is essential to implement screening and prevention strategies for cardiovascular diseases, as death may be the first manifestation of the cardiovascular disease. Currently, as coronary heart disease is the most common heart disease, it isrecommended to track risk factors for atherosclerosis through blood pressure measurement, smoking cessation, blood glucose measurement, and lipid profile (Gerber [b], 2006). Despite the limitations inherent to the collection of information based on death certificates, in addition to the absence of a clear definition of sudden cardiovascular death, the set of data allowed us to state that there was a trend of reduction of SCD in the country in the period evaluated.

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