ABSTRACT

Objective: to determine the epidemiological characteristics of Cardiopulmonary Arrest (CPA) victims assisted by the Emergency Medical Services (EMS) in a remote city in Minas Gerais State. Methodology: cross sectional study during the period of 2008 to 2009, using secondary data obtained from a Pre-Hospital Care Form (PHCF) from cardiac arrest victims, assisted by the EMS in a remote city in Minas Gerais State, Brazil. Data collection was performed at the EMS central unit. The data were stored in a Microsoft Excel 2003 spreadsheet, and analyzed by simple statistics and presented in figures. The study was approved by the Ethics Committee (CEP) at the Pontifícia Universidade Católica de Minas Gerais (PUC/Minas), by protocol CAAE - 0519.0.000.213-10. Results: CPA occurred in both sexes, predominantly among individuals older than 51 years (72.7%) and assisted by Advanced Support Units (97.2%). Asystole electrical activity was observed in 42.2% of the cases. Successful resuscitation occurred in (19.3%), where (26.7%) died on the spot without procedures and (45.8%) of the cases with procedures. Comparing the CPA care in the year 2009 to 2008 there was an increase of (64.5%). Conclusion: reafirma the need for educational and preventive actions aimed at patients with cardiovascular disease, the social importance of EMS and early treatment for victims. Descriptors: cardiopulmonary arrest, emergency treatment, emergency medical services, nursing staff.

RESUMEN

Objetivo: determinar las características epidemiológicas de las víctimas de Parada Cardiorrespiratoria (PCR) atendidas por el Servicio de Atendimiento Móvil de Urgencia (SAMU) de una ciudad del interior de Minas Gerais. Metodología: estudio transversal, no del período de 2008 a 2009, usando datos secundarios, obtenidos en la Ficha de Atendimiento Pre-Hospitalar (FAPH) a las víctimas de PCR, atendidas por el SAMU de una ciudad de Minas Gerais, Brasil. Se colectaron de datos no realizado la unidad central del SAMU. Los datos se almacenaron en planillita electrónica Microsoft Excel 2003, analizados con el uso de las estadísticas simples y presentados en las figuras. El estudio fue aprobado por el Comité de Ética (CEP) de la Pontificia Universidade Catolica de Minas Gerais (PUC/Minas), bajo el número CAAE - 0519.0.000.213-10. Resultados: se observó en ambos sexos, predominantemente entre individuos con edad acima de 51 años (72.7%) y atendidos por la Unidade de Suporte Avanzado (97.2%). El tracado eléctrico de asistolía fue verificado en 42.2% de los casos. El éxito en las maniobras de resuscitación se observó en (19.3%), óbito no local sin maniobras en (26.7%) los casos y con maniobras en (45.8%). Comparando los atendimientos de PCR al año de 2009 con 2008 se observó un incremento de (64.5%). Conclusión: se reafirma la necesidad de acciones educativas y preventivas voltadas para pacientes portadores de enfermedades cardíacas, la importancia social del SAMU y el atendimento precoce às vítimas. Descritores: parada cardiorrespiratoria; tratamiento de emergencia; servicios médicos de emergencia; equipo de enferme.
Sudden death has been considered as a relevant public health problem that affects the contemporary society. Approximately two thirds of those are related to coronary artery disease occurring outside the hospital environment and around 51% of the patients with Acute Myocardial Infarction (AMI) die within the first hour of the symptoms onset.1

Ventricular fibrillation (VF) is the rhythm of the cardiopulmonary arrest (CPA) more prevalent in the pre-hospital environment, for which the only effective treatment is the electrical defibrillation and rapid implementation of the maneuvers of basic life support (BLS); it represents still around 85% of the sudden deaths in adults.2 In this context, the survival rate for a CPA by VF decreases 7% to 10% per minute of delay between the collapse and the first defibrillation. Time, as well as the quality of the resuscitation maneuvers, influences not only the survival, but also the neurological prognosis of the victims with an episode of sudden death.3, 4

Considering the CPA as the absence of respiratory movements, associated to the absence of cardiac mechanical activity, its diagnosis is made by means of the absence of response of the patient when he is called; absence of respiratory movements and absence of carotid pulse. The heart may present cessation of its activity in three lethal cardiac movements, namely: ventricular fibrillation, electrical activity without pulse and asystole.5

The brain begins its death process after four minutes of CPA and after ten minutes it settles an irreversible brain damage. Thus, the concept of cardiopulmonary resuscitation was reviewed by the American Heart Association (AHA) since 1995 for the cardiopulmonary cerebral resuscitation (CPCR), aiming to focus on the importance of urgent intervention in order to reverse the cardiac arrest of the individual with the care/objective to maintain the vital functions of the brain.5

The therapeutic objectives of CPCR consist of performing chest compressions and ventilate the lungs, increasing the diastolic blood pressure in the aorta, and simultaneously intervene in specific situations of the etiology of each cardiac arrest, in an attempt to restore an spontaneous and effective rhythm, treating the hypoxic lactic acidosis, the hemodynamic instability after CPA and especially take measures that protect the ischemic brain.6-7

The advances in the early treatment of CPA by means of cardiopulmonary resuscitation maneuvers divided into Basic Life Support (BLS) and Advanced Life Support (ALS) adopted by the team of Pre-hospital Care (PHC) of the Emergency Medical Service (EMS), allow the recovery of the victims of CPA, avoiding the possible complications and increasing the survival rate, thanks to early intervention.

The PHC is defined as any and all performed assistance, direct or indirectly, outside the hospital, through various means and methods available as an adequate response to a request, which may vary from a simple medical orientation or the dispatch of a unit of basic support (UBS) or a unit of advanced support (UAS) to the place of the accident, aiming the life maintenance and/or the minimization of sequelae.8

The success on the recovery of CPA depends on a series of critical interventions. These interventions were symbolically grouped by the AHA in four consecutive and interdependent links, which together constitute the chain of survival. This chain has the objective of identifying and prioritizing the essential actions for the CPR care and consist of the early access to care that would be the activation of the emergency service and the request of a defibrillator, in CPR (to maintain the vital functions), in the early defibrillation and the advanced support of the early life.

The Resuscitation Committee of the AHA is a reference in teaching and research in cardiopulmonary resuscitation in the world. The investment of this organ together with several other committees of CPR of international representation made it possible from the year 2000 the development of the global consensus of resuscitation that generated unique international guidelines about the CPR care.

By means of the implementation of the Emergency Medical Service (EMS), by the Health Ministry, it was possible to improve the quality of assistance to the victims of trauma of any etiology and, also, provide an specialized treatment to those people who are affected by clinical emergencies in general, providing a fast and early care, still at the place of the accident.9

Given the above, this study aims to determine the epidemiological characteristics of the victims of the Cardiopulmonary Arrest
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(CPA) assisted by the Emergency Medical Service (EMS) of a small city in Minas Gerais.

**METHODOLOGY**

Cross-sectional study, in the period of 2008 to 2009, using secondary data obtained in the Pre-hospital Care Form (PHCF) of the victims of CPA, treated by the EMS in a city of Minas Gerais, Brazil. The data collection was carried out in the central unit of the EMS.

The PHCF is a document filled in by professionals of health of the EMS, doctors, nurses and nursing technicians, in all events of the UASs and UBSSs.

The data collected were: Place, time and date of the event, age, gender, type of event, clinical findings of the victim, vital signs, Glasgow coma scale (GCS), trauma score (TS), performed therapeutic interventions, destination of the victim, suspicion of use of alcohol/drug, locations and type of the injury, complications, performed maneuvers of resuscitation by exemplifying: BLS, ALS, defibrillation, use of the Automatic External Defibrillator (AED), use of transcutaneous pacing, chest compressions, drugs used, among others.

The data were stored in a spreadsheet (Microsoft Excel 2003), analyzed with use of simple statistics and presented in figures.

The research was authorized with a Letter of Consent of the institution and had its project sent and approved by the Ethics Committee in Research (ECR) of the Pontifícia Universidade Católica in Minas Gerais (PUC/Minas), in number CAAE - 0519.0.000.213-10 in accordance with the guidelines of the Resolution 196/96, for research with human beings.

**RESULTS AND DISCUSSION**

367 cases of victims of CPA were analyzed in a pre-hospital environment of the EMS of a small city in Minas Gerais and its coverage, in the period of 2008 to 2009, assisted by the team of the UAS e UBS.

There was a predominance of the event in males, 218(59.41%), which can be explained because the registers of the incidence of CPA in women is three times greater in relation to men.10-11

There was a higher concentration of CPA in patients discriminated in the following age ranges, over 71 years old 109(31.36%); from 61 to 70 years old 89(24.79%) and 51 to 60 years old 59(16.62%). It is estimated that 40% of all deaths from cardiovascular diseases in Brazil are in the age group below 65 years old, being 26.8% of deaths from cardiovascular disease are happening in the 25-59 age group.12

The need to practice healthy living habits, like balanced diet, regular physical activity, periodic medical monitoring, stress reduction, avoid smoking and use of legal/illegal drugs are measures to reduce the incidence of sudden death because of cardiovascular diseases and consequently improvement of quality of life.

In the distribution by type of unit of care, there was a higher prevalence of UAS with 357(97.2%). It was observed that in 10 events the UAS was not moved due to the UBS report of victims that presented injuries not compatible with life.

In systematic resuscitation maneuvers the UAS performs invasive and non-invasive procedures, such as: venipuncture, medication administration, placement of definite airway, chest compression, heart rate evaluation, cardiac monitoring, use of defibrillator and verification of death.

The UBS performs maneuvers of BLS, such as: chest compression, venipuncture, manual ventilation with use of masks, use of AED. The performance of the two teams is fundamental to the survival index to the victims of CPA.

The distribution recommended by the decree No. 2.048/MS for the county that integrates the program of pre-hospital care regulates that for every 100 to 150 thousand of inhabitants the county must have a UBS and for every 400 to 450 thousand people it is recommended a UAS13.

By this decree it is also included the distribution and segregation of the units of LBS that assist the victims providing care without medical intervention at the place of event or during the transport until the healthy service and the removal of the patients at risk of death or not and the units of ALS assist from clinical situations to traumatic ones that suffer from lesions that require the maintenance of more complex practices and the invasive practices for survival involve since the diagnosis at the place of the accident until the stabilization and transport of the victim to the hospital.14

In this context, the performance of the team is primordial for the success of the resuscitation maneuvers, the emotional balance of the team, the continuing education, the technical and scientific preparation, associated with a faster response
time, early detection of CPA and activation of the EMS by the community are contributing factors to improve the prognosis of this condition.

The study demonstrates a positive point in the EMS efficiency referring to the time of receipt of the call until the displacement to the place of the event, considering the response time. This confirms that the service accurately assists its events in time, factor that contributes the effectiveness in the assistance of the victims of CPA.

The CPA is a dramatic situation, with a high index of mortality even in situations of ideal time; it is estimated that every minute that the victim remains in CPA, 10% of the survival probability is lost. The training of the staff, the used resources, the standard care and the time/response may have favorable prognostic implications.\(^\text{14}\)

In emergency situations, like the CPA, for example, the EMS (192), fire department (FD) phone number (193), must be immediately activated when the collapse is witnessed. However, there is still ignorance and misuse of the population regarding the activation of those services.\(^\text{15-16}\)

The response time of the PHC services is fundamental in the survival chances of the CPA victims; however, in Brazil there is a deficiency of the emergency service equipped with defibrillator and response time less than five minutes.\(^\text{1,16}\)

There are evidence that victims of CPA that were assisted by this team, in average, had faster immediate survival after CPA, corroborating the importance of engaging units of basic and advanced support in decentralized places for a better coverage of the population.\(^\text{11}\)

It is fundamental the importance of orientations for the population about the detection of sings of the CPA condition with immediate activation of the EMS, besides the process of the communication among the teams, in order to effect the response time, corresponding to the unit leaving the base until the arrival at the place of the accident. This time is primordial for the success of the CPA care.

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others, it is observed that the clinical state that the patient is in, directly interferes in the specificity of the etiology.

One of the difficulties found in this study was the incomplete information of some PHCFs referring to the type of ECG trace shown in the initial care by the EMS staff and the time of detection of the CPA by the applicant until the EMS activation.

In relation to the trace shown in the initial care of the CPA, it was observed that the highest percentile was the asystole rhythm with 155(42.24%) followed by VF 32(8.7%), AESP 14(3.8%) and VT without pulse 6(1.6%) and a high margin of PHCFs that did not identify the initial rhythm with 160(43.6%), this fact is justified by the lack of description of the initial rhythm.

The VF is the arrhythmia in which the coronary cells present anarchistic movements of fasciculation, without ventricular contraction, the ventricular tachycardia without pulse. Asystole is characterized by the absence of electrical activity of the heart, with the isoelectric line, and it is the most common cause of CPA in patients with serious diseases, having a reserved prognostic.

The cardiovascular system tries to adapt itself before the hemodynamic changes resulting from the cardiac rhythm disturbances; therefore, the choice of therapeutic intervention must consider the state of the cardiovascular system and the possible adaptations that are found.

In this context, the early detection of CPA associated to an immediate care of the EMS with the use of AED in the conditions of chockable rhythms, like the VF or ventricular tachycardia without pulse, is a fundamental step for the resuscitation success. This study reinforces the need to maintain the staff updated in the resuscitation guidelines, besides maintaining all the units equipped with the AED and the location of the units in strategic points improving this way the coverage of the whole population in enough time.

Another aspect that may contribute to the success of resuscitation would be the deployment of the AED in places with great concentrations of people associated to the training and qualification of the population.

The time of the maneuver resuscitation will depend on various factors: age of the patient, previous conditions of the victim, CPA etiology and considering that the earlier the team can reverse the CPA frame, the lower will be the risk of neurological deficit and higher the success in the intervention.

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Figure 2. Distribution of the victims of CPA by maneuvers of CPR, assisted by the Emergency Medical Service (EMS) - January, 2008 to December, 2009 (n=367). (Source: data of the study)

The CPA maneuvers and the advanced techniques of vital support are essential to save the lives of patients with CPA. It is, however, the objective of the resuscitation staff not only saving the life of the victim, but also making it possible for him to survive with quality after the event. It is observed a higher frequency of hospital discharges in group of patients after CPA in which the resuscitation maneuvers were initiated within 4 minutes of the arrest and the rest of the maneuvers of the Advanced Life Support in a period within 8 minutes.

The National Association of Emergency Medical System Physicians (NAEMSPE) and the Committee of Trauma of the American School of Surgeons recommend the following protocol: it is considered the end of resuscitation in victims of trauma in cardiopulmonary arrest witnessed by the emergency staff, after 15 minutes of unsuccessful attempts of resuscitation and victims with more than 15 minutes of transport until the arrival of the health unit. The victims of drowning, electric shock by a lightning, hypothermia, or in those in which the trauma mechanisms do not correlate with
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...related to the interval between the event and the shock application, this fact justifies the effort expended by the EMS staff arriving on the scene with the shortest time possible. 19

The endotracheal intubation can be performed through the mouth or the nose, the ability to execute this technique of intubation and the clinical conditions of the victim will be determinant conditions for the choice of the path. 25

This study reinforces the need of the complete fill of all the fields of the PHCFs, especially the defibrillation procedure, with the objective of verifying the rhythm detected in the moment of the initial evaluation and possible interventions and subsequent analysis.

The most used drugs in the assistance of these victims were: epinephrine, corresponding to 72(26.2%), atropine sulfate 49(17.8%), amiodarone 25(9%), norepinephrine 9(3.3%), sodium bicarbonate 8(2.9%), calcium gluconate 3(1%), dobutamine 2(0.8%), lidocaine and hypertonic glucose solution 1(0.4%) and it was not registered 105(38.2%). In the CPA care the use of some drugs is essential as a contributor in the treatment to reverse the arrhythmia; the main drugs used were: epinephrine, the most used in the treatment, atropine sulfate, amiodarone, calcium gluconate, sodium bicarbonate and norepinephrine.

The preferred paths for the administration of drugs during the cardiopulmonary arrest are the endovenous or intraosseous; in patients where the endovenous access is difficult it must be installed immediately through the intraosseous via; drugs that are administered through endotracheal tube (ETT) has a negative factor, which is the chest compressions that must be suspended in the moment of the administration; the ideal doses through this via are unknown. 26

After the event of the CPA, there is a considerable myocardial dysfunction and the proper attention must be given in order to maintain the patient hemodynamically stable by means of the administration of inotropic and vasoactive drugs, commonly found in units of intensive therapy. 26

It is extremely important that the staff involved in the victim care has the ability in venous puncture for the administration of these drugs and knowledge about the drugs used in the CPR; in this study it was identified the drugs: epinephrine, atropine sulfate and amiodarone as the most used, because they were the first drugs chosen in the assistance...
of the CPA victim.

Another relevant aspect is the incomplete fill of the PHCFs, which deserves to be discussed by the staff, and aims to verify the response of these drugs, the control of material expenses and avoiding the underreporting of the interventions. From the 367 victims of CPA in the period of the research, it was found death with CPR maneuvers 174(46.04%), and transported to the reference hospital after the successful maneuvers 71(19.37%).

For a successful resuscitation the pre-hospital care staff must have the initiative, be prepared to work in a team, to make accurate decisions based on previous knowledge and followed by a protocol of assistance. The assistance to a CPA is an effort for the staff, and it is necessary that they coordinate their activities to assure the quality of assistance, considering that the bad performance by their members may compromise the result of their effort during resuscitation.

When it is shown that classical signs of death, such as: livedo postural, rigor mortis, algor mortis, injuries not compatible with life and patients with chronic diseases in terminal stage, the maneuvers of CPR are not justified.

In this study there was the verification of death at the scene without resuscitation maneuvers 98(26.70%), due to the non-resurectable clinical situations 22(5.99%) and due to the trauma with irrecoverable damage. Not all the events assisted by the EMS are well succeeded for all the victims. Some will have more or less sequels, others will not suffer any lesion and a parcel will not be able to survive, dying later. This type of situation requires the team to have emotional balance and sensitivity.

With the advances of pre-hospital care, the victims of CPA are cared at the place of the event, assisted by an emergency unit with not dispensable equipment in the resuscitation and a qualified staff and prepared for the assistance in enough time. It is perceived success in resuscitation, according to what is shown in the study.

In relation to the CPA care among the week days there was a higher prevalence in working days with 240(66.22%), subsequently Saturdays with 77(20.98%), and in less number Sundays reaching 47(12.8%). However, what is called attention is the great percentile of care of CPA victims on Saturday, a study that corroborates another study carried out in the metropolitan region of Belo Horizonte, which it was identified the days with a high frequency, like Saturday and Tuesday.

It is observed an increase of 64.5% in the number of CPA in the year 2008 until 2009, in this sense, the great prevalence found here is one reason for concern for the people involved in the health/disease process regarding the preventive measures.

It is important to highlight that these numbers have shown the importance of the improvement and interaction in the primary, secondary and tertiary levels; in this sense it is perceived the exacerbated advance of this harm, thus it is necessary the elaboration of programs and prevention policy and control of these situations. The increase of CPA assistance in the year 2009 may be associated to the knowledge of the population about the situations of CPA frames, ease of access to the service provided by the EMS and the population growth.

The CPA is a sudden event, and may occur in several places, in this context the EMS must...
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be prepared, with units distributed in varied places of the county and region, optimizing the care as soon as possible.

**FINAL CONSIDERATIONS**

The CPA victims assisted by the EMS in a city of Minas Gerais in the period of 2008 until 2009 are in the age group over 51 years old. From the 367 victims assisted there are 218 male cases and 149 female cases.

These data reveal the need of an approach and educational practices related to the man’s health, what it could be the elaboration of programs that aim the promotion of health and prevention of cardiovascular diseases. In relation to the age it was shown that the need of a special attention towards the people of the age group over the fifth decade of life, which orientates the change of the lifestyle.

Cases of clinical etiology prevailed, assisted by the BLS and ALS with the performance of several therapeutic interventions with a positive result in the resuscitation maneuvers in some cases.

It can be considered that the early detection of CPA, the response time of unit, the team work, the technological resources, the age and etiology of CPA are factors that contributed for the success in the cardiopulmonary resuscitation.

It is very important that the assistance of the victim be as fast as possible, for the greater the time without assistance the less the chance of survival.

It is observed a great percentile of home events that showed the vulnerability of the people in their houses, being susceptible to several diseases including CPA.

It is highlighted that it is necessary a greater effort of the competent organs in relation to the primary, secondary and tertiary attention like educational practices and preventive actions in order to reduce this statistics. The success of the EMS care contributed for the survival of these victims, optimizing the final outcome. One of the variables that stood out most was the considerable increase of the number of CPA in the year 2008 until 2009, in this sense the high prevalence found here is a reason for concern for the people involved in the health/disease process relating to the preventive measures.

As a limitation we found a failure relating the incomplete registration of the PHCFs, the fact may be plausibly justified by the situation of urgency that includes the care of the victims and due to the instrument to be manually filled in; by the results this study shows the need of improving the complete fill of the forms.

It is perceived the need to computerize the system, with the implementation of a data base named Utstein, indicated to evaluate the specific variables of CPA, which today is being used in many bases of the EMS, demonstrating organization and improvement of the information that are filed.

In this scenario it is indispensable the importance of the EMS in the pre-hospital assistance in the face of the society, and the benefit that was obtained with the creation of this service, which has equipment and trained professionals in various situations of urgency and emergency, assisting all the people without social distinction and contributing significantly for the development in the survival incidence. The results of this research may be important in the sense of evaluating the service, set goals of public policy towards the prevention of these diseases and stimulating researchers to carry out new investigations involving the referred subject.

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