ABSTRACT
Objective: to analyze the characteristics of care provided to victims of out-of-hospital cardiac arrest (OHCA) that received cardiopulmonary resuscitation (CPR) maneuvers. Method: retrospective epidemiological study that assessed 1,740 cardiac procedures conducted by the Mobile Emergency Care Service of Belo Horizonte. Data collection was based on Utstein style and data were analyzed using the R software, version 2.15.3. The study was approved by the Research Ethics Committee, CAAE No. 0711.0.203.410/11. Results: men corresponded to 60.1% of the cases and the average age was 63 years. The average response time was nine minutes. Asystolia was the initial rhythm in 50.6% of the cases. There was return of spontaneous circulation in 21.1% of the cases. CPA witnessed by lay bystanders accounted for 58.7% of the occurrences. In 5% of them, CPR maneuvers were performed. Conclusion: asystolia was the rhythm more often identified, and it may be related to low response time and the limited role of laypeople addressing the CPA. Descritores: Out-of-Hospital Cardiac Arrest; Cardiopulmonary Resuscitation; Emergency Medical Services; Pre-Hospital Care.

RESUMO
Objetivo: analisar as características dos atendimentos a vítimas de parada cardíaca (PCR) extra-hospitalar que receberam manobras de ressuscitação cardiopulmonar (CPR). Método: estudo epidemiológico, retrospectivo que analisou 1.740 atendimentos realizados pelo Serviço de Atendimento Móvel de Urgência de Belo Horizonte. A coleta dos dados foi baseada no estilo Utstein e os dados foram analisados pelo software R versão 2.15.3. O estudo foi aprovado pelo Comitê de Ética em Pesquisa, CAAE n° 0711.0.203.410/11. Resultados: o sexo masculino representou 60.1% dos casos e a mediana da idade foi de 63 anos. A mediana do tempo-resposta foi de 9 minutos. A assistolia foi o ritmo inicial em 50.6% dos casos. Houve retorno da circulação espontânea em 21.1% dos casos. As PCR presenciadas por leigos foram 58.7% das ocorrências. Em 5% delas foram realizadas manobras de CPR. Conclusão: a assistolia foi o ritmo mais frequentemente identificado, podendo ser relacionado ao tempo-resposta elevado e à atuação limitada de leigos frente à PCR. Descritores: Parada Cardíaca Extra-Hospitalar; Ressuscitação Cardiopulmonar; Serviços Médicos de Emergência; Assistência Pré-Hospitalar.

RESUMEN
Objetivo: analizar las características de la atención a las víctimas de parada cardíaca extrahospitalaria (PCEH) que recibieron las maniobras de resucitación cardipulmonar (RCP). Método: estudio epidemiológico retrospectivo que analizó 1.740 atendimientos realizados por el Servicio de Atendimiento Móvil de Urgencia de Belo Horizonte. La recolección de datos se basó en el estilo Utstein y los datos fueron analizados con el software R, versión 2.15.3. El estudio fue aprobado por el Comité de Ética de Investigación, CAAE N° 0711.0.203.410/11. Resultados: el sexo masculino representó el 60.1% de los casos y la edad promedio fue de 63 años. El tiempo de respuesta promedio fue de nueve minutos. El ritmo inicial fue asistolia en 50.6% de los casos. Hubo retorno de la circulación espontánea en 21.1% de los casos. Las PCEH fueron presenciadas por leigos en 58.7% de los casos. En 5% de ellas fueron realizadas maniobras de RCP. Conclusión: asistolia fue el ritmo identificado más frecuentemente y esto puede estar relacionado con el largo tiempo de respuesta y la función limitada de los testigos legos delante de la PCEH. Descritores: Parada Cardíaca Extrahospitalaria; Resucitación Cardiopulmonar; Servicios Médicos de Emergencia; Asistencia Prehospitalaria.

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INTRODUCTION

Currently, diseases of the circulatory system (DCS) represent the main leading cause of death in developed and developing countries. In the United States, about 300,000 people suffer an acute myocardial infarction per year and only 15% survive this aggravation.\(^1\) Data from the Mortality Information System, for the year 2010, show that DCS accounted for about a third (28.7\%) of the total number of deaths due to defined causes in Brazil.\(^2\) Among these, the majority (76.0\%) occurred due to acute myocardial infarction, because the first form of clinical presentation of the disease is sudden death in a large number of cases.\(^3\)

Sudden death is defined as the unexpected death of cardiac etiology that occurs immediately or within one hour after the onset of ischemic heart disease symptoms.\(^4\) The clinical condition that characterizes sudden death is cardiac arrest (CA) defined as the cessation of mechanical cardiac activity confirmed by the absence of circulation signs (lack of responsiveness and pulse, apnea or agonic breathing).\(^5\)

It is estimated that more than half of CA related to ischemic heart disease occur outside hospital and require appropriate and urgent intervention strategies.\(^6,7\) In 2003, the Ordinance MS 1864 of the Ministry of Health instituted the Mobile Emergency Care Service (SAMU 192) in municipalities and regions of the whole Brazilian territory. With the implementation of this service, the emergency call is routed to a specialized service for quick access and early onset of cardiopulmonary resuscitation (CPR) maneuvers provided to the person victim of CA.\(^8\)

Two studies conducted in the SAMU of Belo Horizonte (SAMU/BH) on care provided to victims of CA, one for the year 2005 and the other comprising the period between December 2008 and October 2010, detected that these cases corresponded, respectively, to 30.2 and 29.9\% of the total occurrences served by advanced support service units.\(^9,10\) This way, considering the panorama of morbimortality of cardiovascular diseases, associated with the large number of care procedures provided to people victims of CA performed by the SAMU/BH, this study was proposed with the purpose of analyzing the characteristics of care provided to victims of CA who had received out-of-hospital cardiopulmonary resuscitation (CPR) maneuvers.

This analysis will make it possible to know the reality of care provided by the SAMU/BH through the assessment of variables that may influence the quality of patients' care and the immediate survival indexes. Accessing this information is critical for updating care protocols, investment in continuing education and appropriateness of human and material resources, among others.

METHOD

This is an epidemiological and retrospective study conducted in the SAMU of the municipality of Belo Horizonte, State of Minas Gerais, Brazil, which has a population of 2,375,151 inhabitants.\(^11\) The physical structure of this service consists of a Control Center that receives the demands of the community, via telephone number 192, sorts the requests of pre-hospital care and defines the best procedure for each case. In addition to the demands of the community, it meets the requests of Basic Health Units and Emergency Care Units, performing secondary care and inter-hospital transports of patients within the hospital network accredited by the Unified Health System.

As criteria for inclusion, we considered pre-hospital care forms (PHCF) of people over 18 years of age, of both sexes and with cardiopulmonary arrest (CPA) presumably of cardiac origin, and who had undergone CPR maneuvers performed by staffs of Advanced Support Units (ASU) of SAMU/BH in non-hospital environment, from January 2006 to October 2010.

In the period studied, the ASU performed 44,818 care procedures and there were 9,248 forms of care provided to people victims of CA. Among these, 7,213 forms corresponded to people victims of CPA of probable cardiac origin and 1,740 had records of CPR maneuvers performed, which corresponds to the population of our study. The flowchart of inclusion and determination of the population is presented in Figure 1.
The data were collected by the researchers. After consulting the records of care provided by the ASU of the SAMU/BH in the period of study and identifying cases of people victims of CA who had received CPR maneuvers, the information was compiled in an electronic form prepared through the Access® 2007 software. The variables analyzed were based on Utstein style. This is a set of guidelines for data collection and establishes the definitions of terms related to CA aiming at standardization of studies on this topic.

The data were submitted to descriptive statistical analysis using the R software version 2.15.3 for the calculation of absolute and relative frequencies. Subsequently, we calculated the measures of central tendency and dispersion for age and ambulance response time (RT). The research project was approved by the Research Ethics Committee of the Federal University of Minas Gerais, with the Protocol No. 0711.0.203.411/11.

RESULTS

The 1,740 people that had received CPR maneuvers performed by the teams of the ASU-SAMU/BH corresponded to 24.1% of the total number of care provided to people with CPA of probable cardiac origin. Among these, 60.1% were men and in 1.2% of the records this information had not been given. Age ranged from 15 to 103 years, with an average of 63 years and 75% of people were up to 75 years old. Comorbidities were recorded in 708 (40.7%) cases. These data are presented in Table 1.

Table 1. Comorbidities of people who received cardiopulmonary resuscitation maneuvers performed by SAMU/BH teams. Belo Horizonte, 2006-2010.

<table>
<thead>
<tr>
<th>Comorbidity</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systemic arterial hypertension</td>
<td>278</td>
<td>39.6</td>
</tr>
<tr>
<td>Cardiac disease</td>
<td>268</td>
<td>37.8</td>
</tr>
<tr>
<td>Diabetes Mellitus</td>
<td>120</td>
<td>16.9</td>
</tr>
<tr>
<td>Other comorbidities</td>
<td>128</td>
<td>18.7</td>
</tr>
</tbody>
</table>

There were two or more comorbidities recorded in 10.8% of the forms. As ‘other comorbidities’ we categorized: neoplasias; cerebrovascular accident; Alzheimer’s disease; acquired immunodeficiency syndrome; depression; psychiatric disorder; drug use; hypothyroidism; asthma; arthritis; epilepsy; Parkinson’s disease; obesity; and chronic renal failure, among others. Besides comorbidities, records of alcoholism and smoking habits were found in 95 (0.5%) of the forms.

With respect to the rhythm of CPA, it is worth noting that in a considerable percentage (35.2%) of PHCF, the first cardiac rhythm detected by the ASU teams had not been recorded. In 1,128 forms containing this data, asystolia was the more prevalent rhythm (50.6%), followed by ventricular fibrillation/ventricular tachycardia (VF/VT) without pulse (31.9%) and pulseless electrical activity (PEA).

There were records of the municipality in which care procedures occurred in 97.5% of the PHCF. Among these, the majority (96.4%) was performed in the city of Belo Horizonte. Care had been also carried out in the cities of
Characteristics of care provided to victims...

Caetê, Contagem, Nova Lima, Ribeirão das Neves, Sabará, and Santa Luzia.

The time at which care procedures occurred was recorded in 83.1% of the PHCF. Most care procedures (36.8%) were performed in the morning period (6:00 a.m. to 11:59 a.m.), followed by the afternoon period (27.9%), night period (23.4%) and dawn (11.9%).

With respect to the RT of the ASU, i.e., the time spent in minutes between the call being routed to the Control Center and the arrival of the ambulance to the scene determined, it was found that there were records in 72.6% of the care forms. The RT ranged from zero to 69 minutes with an average of nine minutes.

Most PHCF (55.8%) had no records about the presence or not of someone at the time of the CPA. In 310 cases of CPA, before the arrival of ASU teams to the locations of occurrences, there was a presence of some person and most events (58.7%) had been witnessed by laypeople, followed by Basic Support Unit (BSU) or ASU teams (29.7%) and by people trained in basic life support (BLS) (11.6%).

There were records of CPR maneuvers performed or not before the arrival of ASU teams in 59.3% of the forms. Among these, 95% had been performed by people trained in BLS and only in 5% of cases the maneuvers were conducted by laypeople.

There were records of the presence of an ASU team during care provided in 38.4% of the PHCF. The type of intervention performed (BLS or advanced life support [ALS]) was found in 93.3% of the forms and most people (85.3%) had received ALS by the ASU team. Table 2 shows the medicines administered by the ASU teams in care provided to people who had received CPR maneuvers.

Table 2. Medications used during care provided to people who had received cardiopulmonary resuscitation maneuvers performed by SAMU/BH teams. Belo Horizonte, 2006-2010.

<table>
<thead>
<tr>
<th>Medications</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Epinephrine</td>
<td>1,264</td>
<td>72.6</td>
</tr>
<tr>
<td>Atropine sulfate</td>
<td>956</td>
<td>54.9</td>
</tr>
<tr>
<td>Amiodarone hydrochloride</td>
<td>377</td>
<td>21.7</td>
</tr>
<tr>
<td>Other</td>
<td>104</td>
<td>6</td>
</tr>
</tbody>
</table>

In addition to epinephrine, atropine sulfate and amiodarone hydrochloride, medications such as vasopressin, lidocaine, sodium bicarbonate, calcium gluconate, and magnesium sulfate had been used less frequently; being grouped into a variable named ‘other medications’ and recorded in 6% of cases. Defibrillation was carried out in 41.3% of people; being performed in greater numbers (59.4%) by using the manual defibrillator, followed by automated external defibrillator (AED) (40.6%).

The return of spontaneous circulation (RSC) occurred in 368 (21.1%) people. Among them, the majority (56.4%) was composed of men and age ranged from 18 to 96 years, with average of 61 years; 87.5% had been referred to public hospitals and there were no records of patients destination in 9% of the forms. Figure 2 summarizes the main characteristics of care provided to the population studied.
DISCUSSION

In this study, the performance of CPR maneuvers occurred in 24.1% of CPA victims with probable cardiac origin. In 2012, a study that had assessed the outcome of care provided to people with CPA that had received CPR maneuvers only performed by the ASU of SAMU/BH showed a similar result (26.4%).

A prospective study developed in the city of Copenhagen, Denmark, assessed the outcome of 499 cases of CPA that had occurred outside hospitals and found that CPR maneuvers had been performed in 53.3% of the population studied. The authors pointed out characteristics of people who had not received CPR maneuvers, such as advanced age, long ambulance RT, asystolia as first cardiac rhythm identified by the service team and, in some cases, prolonged anoxia and terminal stage of the disease.

In our study, we found that the occurrence of CPA in men was 1.5 times higher than in women. A similar proportion (occurrence of CPA 2.0 times higher in men) was detected in four studies conducted in Brazil. A study conducted in the city of Osaka, Japan, also found that men had the double of CPA outside hospital than women, and this difference was significant in all age groups. The average of 63 years of age found in our study is in line with the studies that found averages of 64, 63, and 66 years of age.

With respect to the morbidity history, systemic arterial hypertension, heart diseases, and diabetes mellitus were the most prevalent. However, as in more than half of the population studied, there were no records about comorbidities. It is possible that these figures had become even more expressive if there had been such records in every form. These comorbidities were also the more prevalent in the studies conducted in the SAMU/BH and in the SAMU of Aararas, State of São Paulo.

When caring for CPA victims, the ASU team prioritizes checking the patient’s cardiac rhythm. This rhythm not necessarily coincides with the initial in the CPA, since it is observed a few minutes after the occurrence of the injury, except in CPA witnessed by the ASU team. The big absence of the cardiac rhythm in PHCF, reaching 35.2%, and the prevalence of asystolia followed by VF/VT and PEA, were also reported in the three studies previously conducted in the SAMU/BH.

Studies that assessed outcomes of care provided to patients that had suffered CPA outside hospital in the United States and in the cities of Osaka and Copenhagen showed that the incidence of VF/VF as first rhythm observed has been decreasing in recent decades and today it occurs in around 23% of the cases. The authors state that the delays in calling for help may be responsible for the low frequency of VF/VT as initial rhythm, but they do not rule out that the incidence is actually decreasing because RT is much better when compared to that found in Brazilian studies.

The shorter the time, the faster the victims are cared for, which can make a difference for their survival. Ordinance GM 1.010/2012 stipulates that among the indicators for evaluating the SAMU 192, minimum, medium and maximum RT should be assessed, monitored and presented to the Ministry of Health every six months. In our study, the average RT was nine minutes. When comparing this result with those published in previous studies assessing the RT of SAMU/BH, it can be observed that there has been a time reduction, since RT was around 10.3 min in 2007 and 10.4 min in 2010.
A study conducted in the city of Porto Alegre, State of Rio Grande do Sul, evidenced a RT of 13 minutes and the authors report that although there were other factors, this high RT may have compromised the survival of CPA victims. Other two studies conducted in the Republic of Singapore and in the State of Arizona, United States, found a RT of seven and five minutes respectively.

Most care performed by the ASU teams occurred in the morning period, suggesting that the CPR also occurred during this period. A study conducted in the United States and in Canada showed that regardless of gender, initial cardiac rhythm and the presence or not of someone at the time of the CPA, the chance of having a CPA in the period between 6:01 a.m. and 12:00 a.m. was 2.02 times greater than in the period between 00:01 a.m. and 6:00 a.m.

Research conducted in countries like the United States, Germany and Japan detected that the largest number of care provided to people with CPA occurred in the period from 08:00 a.m. to 12:00 a.m. Discussions on this fact indicates that there is a higher risk of having a CPA in up to three hours after awakening than at other times of day, due to increased blood pressure and heart rate, which raises the vascular tonus, blood viscosity and platelet aggregation.

We found that the presence of a basic support team during care procedures had been recorded in 38.1% of the cases. In the presence or suspicion of a CPA victim, the Control Center of SAMU, according to the service protocol, usually summon the nearest BSU to the location so that the victim can receive CPR and early defibrillation using the AED until the arrival of the ASU team. It is important to highlight that the AED was incorporated by the SAMU/BH in December 2007. Prior to this date, when a BSU team arrived first for caring for a person victim of CPA, they just performed chest compression and ventilation maneuvers.

A study conducted in the SAMU/BH, which assessed all care provided to CPA victims by the service from December 2007 to March 2008, showed that there was joint participation of BSU and ASU teams in 39% of the cases, and in 93% of the cases the BSU team arrived on average 15 minutes before the ASU team. The author emphasizes the importance of the incorporation of the AED in the BSU and the need for conducting continuing training of the teams in BLS.

The CPA had been witnessed by someone in 44.2% of the cases, and mostly by laypeople. This data, when compared to the three Brazilian studies, which reported a percentage of 35.2%\textsuperscript{10}, 30%\textsuperscript{11}, and 28%\textsuperscript{14}, shows an increase in the occurrence of witnessed CPA.

CPR maneuvers were carried out before the arrival of the ASU team in more than half of patients, being most often carried out by people trained in BLS. The performance of CPR maneuvers by laypeople occurred in just 5% of the cases. This data indicates that, although doctors guide people by phone on how they should proceed until the arrival of the ambulance, these guidelines are not always followed.

The emotional imbalance in view of the situation, the lack of appropriate skills to carry out CPR maneuvers and the possibility that the victim was a close relative often prevent the layperson to act appropriately.\textsuperscript{13} It is extremely important that people are able to act against a CPA. Recent studies state that performing CPR maneuvers with quality and the use of AED by non-health professionals until the arrival of the emergency service can increase the chance of survival by up to two times.\textsuperscript{28,29}

The drugs most frequently recorded in the care forms (epinephrine, atropine sulfate and amiodarone hydrochloride) were those established under international consensus to care for people with CPA.\textsuperscript{4} It is important to highlight that with the release of guidelines for emergency cardiovascular care after the period of this study (October 2010), atropine, until then recommended for treating people victims of CPA in asystolia or PEA, is no longer a drug of choice.

The percentage of SCR observed in this study was lower than that identified in the same municipality in 2007\textsuperscript{20} (25.1%); however, similar to those percentages found in other Brazilian studies.\footnote{11,14} Probably, the most critical factor for patients with CPA is the time between the start of the collapse and the beginning of care procedures, and the chance of survival is smaller if this event is not witnessed by someone. Studies show that the most frequent determining factors for the occurrence of CPA are the RT, CPA being witnessed, VF/VT as initial rhythm, and access to ALS.\textsuperscript{10,11,15,17,21}

As main limitation, this study presented the absence of data records on the care forms. Therefore, it is important to establish ways of sensitizing the professionals on the importance of accurate and comprehensive records, which can significantly contribute to more reliable assessments of the service.

\textsuperscript{12,23}

\textsuperscript{Characteristics of care provided to victims...}
CONCLUSION

From the analysis of the characteristics of care provided to people with CPA receiving CPR maneuvers, it was possible to observe that the highest occurrence of CPA in men and the average age of 63 years approach to data from developed countries. Few people of the public that witnessed most of the CPA performed actions beyond calling the SAMU for help, and asystolia was the initial rhythm detected by the teams in more than half of the cases. The nine-minute RT and the unfamiliarity of the lay population regarding BLS in order to start CPR maneuvers are factors that interfere in the early care provided to people victims of CPA and consequently in the outcome of care provided by pre-hospital service in Belo Horizonte.

It is possible that investments in mass training of the lay population in BLS, provision of AED at strategic locations, such as places of difficult access, and measures aimed at the reduction of the RT by SAMU teams, such as correct identification of locations, can contribute not only to increase the number of immediate survival of the victim of CPA outside hospital, but also to a better quality of life for people who survive this event when cared early.

REFERENCES


Corrêa AR, Carvalho DV, Morais DA.

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