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Analysis of availability and adequacy of medicines and materials in emergency vehicles: observational study

Análisis de disponibilidad y adecuación de medicamentos y materiales en vehículos de emergencia: estudio observacional

Análise da disponibilidade e adequação de medicamentos e materiais nos carros de emergência: estudo observacional

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Abstract

The aim is to analyze the availability and adequacy of medicines and materials for emergency vehicles in accordance with current safety standards and recommendations. This is an observational and quantitative study, carried out in open and closed sectors of adult care in a cardiology hospital. Statistical calculations were performed using the Statistical Package for the Social Sciences software, version 2.0 and p value was considered significant when ≤ 0.05. The result was the analysis of 5130 items, arranged in 11 emergency cars, 6 from open sectors and 5 from closed sectors. A total of 1780 (34.70%) medications, 1241 (24.19%) vascular access materials, 742 (14.46%) airway materials and 1367 (26.65%) materials for assessment and diagnosis were identified. Most items found were classified as standard (69.98%), while 30.02% as non-standard. Regarding materials, there was no statistically significant difference between open and closed sectors (p value 2.71). However, when comparing the drug groups, electrolytes and vasoactive amines showed a significant difference, both were in greater quantity in the open sectors.

Descriptors: Heart Arrest; Emergency Nursing; Patient Safety; Equipment and Supplies, Hospital; Stockpile.

Resumén

El objetivo es analizar la disponibilidad y adecuación de medicamentos y materiales para vehículos de emergencia de acuerdo con las normas y recomendaciones de seguridad vigentes. Se trata de un estudio observacional y cuantitativo, realizado en sectores abiertos y cerrados de atención de adultos en un hospital de cardiología. Los cálculos estadísticos se realizaron utilizando el software Statistical Package for Social Sciences, versión 2.0 y el valor de p se consideró significativo cuando ≤ 0.05. El resultado fue el análisis de 5130 ítems, ordenados en 11 carros de emergencia, 6 de sectores abiertos y 5 de sectores cerrados. Se identificaron 1780 (34,70%) medicamentos, 1241 (24,19%) materiales de acceso vascular, 742 (14,46%) materiales de vía aérea y 1367 (26,65%) materiales para evaluación y diagnóstico. La mayoría de los ítems encontrados se clasificaron como estándar (69,98%), mientras que el 30,02% como no estándar. En cuanto a los materiales, no hubo diferencia estadísticamente significativa entre los sectores abiertos y cerrados (valor de p 2.71). Sin embargo, al comparar los grupos de fármacos, los electrolitos y las aminas vasoactivas mostraron una diferencia significativa, ambos se encontraban en mayor cantidad en los sectores abiertos.

Descriptores: Paro Cardíaco; Enfermería de Urgencia; Seguridad del Paciente; Equipos y Suministros de Hospitales; Reservas de Emergencia.

Resumo

Objetiva-se analisar a disponibilidade e adequação de medicamentos e materiais dos carros de emergência de acordo com as normas de segurança e recomendações vigentes. Trata-se de um estudo observacional e quantitativo, realizado nos setores abertos e fechados de atendimento adulto em um hospital cardiológico. Os cálculos estatísticos foram realizados pelo *software Statistical Package for the Social Sciences*, versão 2.0 e p valor foi considerado significativo quando ≤ 0.05. Resulta-se a análise de 5130 itens, dispostos em 11 carros de emergência, sendo 6 de setores abertos e 5 de setores fechados. Foram identificados 1780 (34,70%) medicamentos, 1241 (24,19%) materiais de acesso vascular, 742 (14,46%) materiais de via aérea e 1367 (26,65%) materiais de avaliação e diagnóstico. A maioria dos itens encontrados foram classificados como padrão (69,98%), enquanto 30,02% como não padrão. Em relação aos materiais, não houve diferença estatística significativa entre os setores abertos e fechados (p valor 2,71). Porém ao comparar os grupos de medicamentos, os eletrólitos e as aminas vasoativas apresentaram diferença significativa, ambos estavam em maior quantidade nos setores abertos.

Descritores: Parada Cardíaca; Enfermagem em Emergência; Segurança do Paciente; Equipamentos e Provisões Hospitalares; Reservas de Emergência.

Introduction

This study addresses the availability and adequacy of medicines and materials for emergency vehicles (EC). It is understood that the theme of this study has a direct impact on the success and quality of care in cardiac arrest (CPA) in the in-hospital environment.

Statistical data show that CPA is the leading cause of death in the United States, Europe, and Canada, and depending on the causing heart rhythm or early identification of the event, the survival rate can vary from 2% to 49%. The National Registry of Cardiopulmonary Resuscitation in the United States showed approximately 14,720 CRA in adults, demonstrating that 44% of in-hospital CRA victims had return of spontaneous circulation (ROSC) and only 17% survived to hospital discharge[1-3].

It is estimated that in Brazil there are about 200,000 CPAs a year, and despite advances related to the prevention and treatment of cardiovascular diseases, research shows that in 2016 there were 339,000 deaths from these causes, which is equivalent to approximately 30% of the deaths in the country[4,5].

Some authors describe that around 30% of cardiopulmonary resuscitation (CPR) maneuvers are successful, as the survival of post-CPA patients depends on factors such as qualified professionals and adequate material resources. In this sense, drugs and materials used to reverse CRP are in the EC, which works as a "cabinet", whose standardization is proposed by the Brazilian Society of Cardiology based on the recommendations of the American Heart Association (AHA)[6-9].

By ensuring that the EC has all the materials and medications necessary for an effective care, the improvement of the safety of health care is ensured, preventing possible incidents and damage to patients[10].

Thus, the aim of this study was to analyze the availability and suitability of medicines and materials from ECs in accordance with current recommendations.

Methodology

Descriptive, observational, cross-sectional study, with a quantitative approach, in a cardiology hospital in the city of Rio de Janeiro, in open and closed sectors. All 22 steps proposed by the checklist Strengthning the Reporting of Observational Studies in Epidemiology (STROBE) for observational studies were completed.

The sample was intentional, consisting of 11 EC who met the inclusion and exclusion criteria. The inclusion criterion was the use of EC specifically for PCR reversal. While the exclusion criterion was the use of EC for other purposes that were not exclusively for CPA care. During data collection, FBs from the operating room were excluded, as they were routinely used for anesthesia during surgeries, and not for emergencies.

For data collection, a structured instrument with open and closed questions was used, formulated by the researchers and based on the characteristics defined for the SC according to the Guideline of support for advanced life support in cardiology of the Brazilian Society of Cardiology (SBC) and the 2015 AHA Guideline.

The instrument was structured in 4 parts, from which medicines, materials for vascular access, assessment and diagnosis, and airway control were evaluated. It is noteworthy that for the construction of the drug group, procainamide was not considered in this study, as it is a drug no longer available in Brazil.

The variables analyzed in the instrument include the identification of materials and medicines according to their organization, identification, and accessibility. There are also questions regarding the arrangement and location of ECs in the sectors, arrangement of medicines according to their similar packaging ("look alike") and similar names ("sound alike").

After data collection, a classification into groups was carried out according to the use and characteristics of the materials and medicines found. Such materials and drugs were classified into the respective groups: drugs, vascular access, airway, evaluation, and diagnosis. These groups were later separated into subgroups according to their similar characteristics and properties.

The items found in the evaluated EC were further divided into 2 recommended and non-recommended groups. All medications and materials that were described in the instrument were considered "recommended". While the items considered "not recommended" were the materials and medicines found in the EC that were not in accordance with the current AHA standard and the literature used.

Data were organized in a spreadsheet for tabulation in the Microsoft Excel® version 2010 software. A descriptive statistical analysis was performed, with measures of central tendency and dispersion. To compare the availability of medicines and materials in the EC between the open and closed sectors, the Mann-Whitney U test was performed, with the results being expressed in simple frequency, percentage (%) and p value given by the U that assesses the degree of interlacing the data from the two groups after sorting.

All statistical calculations were performed using the Statistical Package for Social Sciences (SPSS) software, version 2.0 SPSS 2.0 (SPSS IncTM, Chicago, IL, USA)[11] and were considered when p value ≤ 0.05.

This study was submitted to the research ethics committee, following the ethical, bioethical, and legal aspects of Resolution No. 466/2012. It was subsequently approved on December 13, 2017, under number 79902417.1.00000.5272.

Results

A total of 11 CE was analyzed, 6 from open and 5 from closed sectors. Regarding availability, a total of 5130 items were found, of which 1780 (34.70%) were medications, 1367 (26.65%) assessment and diagnostic materials, 1241 vascular access materials (24.19%) and 742 airway materials (14.46%).

Most items arranged in the EC were identified as recommended n=3590 (69.98%). Among the items evaluated, it is noteworthy that the drug group had the

highest recommended quantity n=1346 (75.62%), followed by the vascular access group, which had 1028 recommended items (82.84%), as shown in the Table 1.

Table 1. Distribution of recommended and non-recommended items found in emergency cars. Rio de Janeiro, RJ, Brazil, 2019 (n=5130)

Groups	Recommended		Not recommended		Total	
	n	%	n	%	N	%
Medicines	1346	75,62	434	24,38	1780	34,70
Assessment and Diagnosis	674	49,31	693	50,69	1367	26,65
Vascular Access	1028	82,84	213	17,16	1241	24,19
Airway	542	73,05	200	26,95	742	14,46
Total	3590	69,98	1540	30,02	5130	100,00

Regarding the disposal of EC, mostly n=9 (81.82%) had adequate physical accessibility within the sector. While in the organization of medications, all 11 (100%) ECs had "look-a-like" and "sound-a-like" medications close to each other, although all of these presented physical distinction strategies. All EC had some type of drug not recommended.

In relation to materials, there was no statistically significant difference between the CE in the open and closed sectors. However, in the analysis of vascular access materials, a statistical difference p=0.04 was found in closed sectors. It is noteworthy that in the closed sectors the presence of assessment and diagnosis materials was lower (20.88%) when compared to the open sectors (31.16%). See Table 2.

Table 2. Comparison of groups between open (n=6) and closed (n=5) sectors. Rio de Janeiro, RJ, Brazil, 2019 (n=2879)

Groups	Open		Closed		*U*
	n	%	n	%	(*p*-value)
Medicines	953	33,10	827	36,74	13,50 (0,78)
Assessment and Diagnosis	897	31,16	470	20,88	6,00 (0,05)
Vascular Access	660	22,92	581	25,81	5,40 (0,04)
Airway	369	12,82	373	16,57	10,00 (0,35)
Total	2879	100,00	2251	100,00	9,00 (2,71)

As the drug group was the item most frequently found in the EC evaluated, it was decided to evaluate the drug subgroups. It was identified that the subgroup of electrolytes and vasoactive amines presented a statistically significant difference, respectively p value = 0.04 and 0.02. It is observed in Table 3 that these two groups of drugs were in greater quantity in the open sectors than in the closed ones.

Table 3. Comparison of drug subgroups distributed in EC in the open (n=6) and closed (n=5) sectors. Rio de Janeiro, RJ, Brazil, 2019 (n=1780)

Medicines	Open		Closed		Total		*U*
	n	%	n	%	n	%	(*p*-value)
Solutions	256	26,86	308	37,24	564	31,69	13,40 (0,98)
Antiarrhythmic	207	21,72	195	23,58	402	22,58	11,00 (0,35)
Electrolytes	202	21,20	170	20,56	372	20,90	5,00 (0,04)*
Vasoactive Amines	237	24,87	112	13,54	349	19,61	12,50 (0,02)*
Sedatives	18	1,89	17	2,06	35	1,97	9,00 (2,71)
Analgesics	12	1,26	17	2,06	29	1,63	13,60 (0,59)
Others	21	2,20	8	0,97	29	1,63	16 (2,86)
Total	953	100,00	827	100,00	1780	100,00	7 (1,28)

Discussion

The availability and adequacy of EC is a recent topic, as it had its first publication in 1972 in the American magazine Injury, it is believed that this publication was the first to describe the necessary items, on the other hand, the article did not specify the nominal relationship and quantity of drugs and materials in the EC, the name of any medication or the quantity of materials listed[12].

The results show that the item found less frequently was related to airway materials (14.46%), a fact that is

worrying, as around 26.95% were considered not recommended. Thus, if an emergency had occurred, only 73.05% of the airway materials found in ECs would be in accordance with the recommendations in the literature, similarly to a prospective study that describes the evaluation of the frequency of "adequate global use" of the ventilation material. and identified only that 62% of EC had all the ventilation material needed for CPR available[13].

Regarding the presence of airway materials, it is known that they are essential in a CPA, since in this situation, the respiratory function is compromised, and thus these materials are responsible for maintaining good ventilation and enabling gas exchange to occur under the best conditions[14].

Regarding accessibility, most EC (81.82%) had adequate physical accessibility. This data reflects an institutional organization management, as studies have shown that the success of CRP reversal is directly linked to the start time of CPR maneuvers. A study that corroborates the effective disposition points out that the EC should be kept in a more visible place, allowing easy access when it needs to be moved to another location[12-15].

In this study, it was identified that only 1 (9.09%) of the EC evaluated had medications that were easy to identify and organize. It was also found that all EC (100%) had "look-a-like" and "sound-a-like" drugs physically close and mostly without any marking that would draw attention to that type of drug, as the literature recommends, since those studies show that approximately 15% of errors arising from changing medications are related to similar names[12-16].

A study that evaluated the content that the EC should have, based on the Brazilian Guidelines – Code Blue of 2003, showed that in the intensive care unit ICU, the EC were better equipped when compared to other inpatient units. However, regarding the evaluation of the items found in the SC in this study, it was observed that there was no statistical difference between the items in the SC between open and closed sectors[17].

However, there was a statistical difference (p value = 0.05) in the assessment and diagnosis group between the sectors, in which it was identified that the closed units had a statistically lower quantity of assessment and diagnosis materials when compared to the open sectors. This result can be understood since closed units, it is believed that the ICU, tend to have greater access to devices possibly used in the evaluation and diagnosis of CRP, such as cardiac monitoring and pulse oximetry[18].

Also, regarding the materials needed in CPR, obtaining a vascular access during CPA is facilitated by means of puncture and preparation materials for vascular access, which are organized and located in the CE for this purpose[19].

In the present study, it was found that the FB in the closed units had a smaller quantity of materials for vascular access when compared to the open sectors (p=0.04). This result may be associated with the fact that critically ill patients hospitalized in closed units regularly use more medications via intravascular access and thus more often have a vascular access, which may be peripheral or central.

During the analysis there was a statistical difference between the subgroups of electrolytes and vasoactive amines, p value = 0.04 and 0.02 respectively. In such difference, both classes were found in smaller numbers in the closed sectors.

As vasopressor drugs are responsible for influencing the increase in cerebral and coronary perfusion pressure during CPR, the significant absence of these in the EC of closed sectors is worrying, since these sectors have a profile of patients in a critical health state how do you report in a job[18].

Regarding the distribution of vasoactive amines in EC between the open and closed sectors, it is essential to reflect on the result found, with vasoactive amines being a potentially dangerous drug (MPP) due to their properties, these, during their use, require specific care with aimed at monitoring cardiac output and organ perfusion, since these medications have a peculiar action on parameters[20].

In addition to vasoactive amines, electrolytes also have a high potential for causing harm to patients when used incorrectly or when in high serum levels, being capable of generating severe arrhythmias, possibly leading to CRP rhythms[21,22].

Conclusion

The development of this research enabled the identification and analysis of drugs and materials located in the EC of a cardiology hospital.

From the data obtained, it was found that the availability and suitability of medications were not in accordance with the recommendations described in the current literature. However, all evaluated CEs were found in easily accessible locations.

Still on the EC, no statistical difference was observed between the open and closed sectors, however when specifically analyzing the drug group, it was found that electrolytes and vasoactive amines were found in greater amounts in the open sectors, which is a result worrisome as such drugs are considered PPM and require special care during storage, preparation, and administration.

This study presented as a limitation the quantity of FB evaluated, although these did not show statistical differences, a larger number of FB would be relevant, as well as a different scenario from the cardiological one.

The analysis of EC with a focus on the effective disposal and adequacy of medicines and materials is of fundamental importance, as it is capable of directly influencing the outcome of CPA, as well as the quality and safety of care provided to the patient.

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