Review Article

Survival of in-hospital cardiorrespiratory arrest: integrative review of the literature

Sobrevivência a parada cardiorrespiratória intra-hospitalar: revisão integrativa da literatura

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ABSTRACT

Many lives are lost by Cardiorrespiratory Arrest (CA) in-hospital, but there are few studies about it. The objective of this study was to identify the available evidence in the literature about in-hospital CA survival. An integrative review of the literature conducted from the guiding question: what is the scientific evidence available in the literature related to survival of in-hospital CA? From the descriptors “Cardiac Arrest”, “Cardiopulmonary ressuscitation" and “Survival”. Selected studies were systematized in the categories: survival rate analysis; factors related to survival and survival rates. As a result, we observed few publications about the theme, varying survival rates, studies with divergent designs and absence of national studies, highlighting the use of Utstein Style registries in the studies. We concluded that guidelines advertisement have been contributing to global survival improvements, and in the Brazilian setting, there is a need to broaden registries about their practices and results.

Descriptors: Cardiopulmonary Resuscitation; Survival; Nursing Care.

RESUMO

Muitas são as vidas perdidas por Parada Cardiorrespiratória (PCR) em ambiente intra-hospitalar, porém existem poucos estudos a respeito. O objetivo deste estudo foi identificar as evidências disponíveis na literatura sobre a sobrevivência a PCR intra-hospitalar. Revisão integrativa da literatura realizada a partir da questão norteadora: quais são as evidências científicas disponíveis na literatura relacionadas à sobrevivência a PCR intra-hospitalar? A partir dos descritores “Parada Cardíaca”, “Ressuscitação cardiopulmonar” e “Sobrevivência”. Os estudos selecionados foram sistematizados nas categorias: análise das taxas de sobrevivência; fatores relacionados com a sobrevivência e taxas de sobrevivência. Diante dos resultados observou-se poucas publicações sobre o tema, taxas variáveis de sobrevivência, estudos com delineamentos divergentes e ausência de estudos nacionais, destacando-se o uso de registros Utstein Style nas pesquisas. Pode-se concluir que a divulgação de diretrizes tem contribuído com melhoria da sobrevivência mundialmente, no cenário brasileiro ainda é preciso ampliar os registros sobre sua prática e resultados.

Descritores: Ressuscitação Cardiopulmonar; Sobrevivência; Cuidados de Enfermagem.

INTRODUCTION

Cardiopulmonary arrest of cardiorrespiratory arrest (CA) is defined as the absence of cardiac mechanical activity, confirmed by the absence of dectectable pulse, absence of responsitiviness and apnea or agonizing, wheezing breathing. The term “cardiac arrest” is commonly used when referring to a patient that is not breathing and does not have a palpable pulse[1].

Cardiopulmonary resuscitation (CR) is defined as a conjunct of manouvers performed after a CA aiming to artificially keep arterial flux to the brain and other vital organs, until the spontaneous circulation return (SCR) happens. Other CR manouvers constitute of better chance to restore cardiopulmonary and brain function in CA victims[2].

Despite of advances in the past years related to CA prevention and treatment, many lives are lost in those events, and for this reason, it still remains as a global public health problem. Even without having the exact problem dimension, due to lack of robust statistics related to it, it is estimated 200.000 CA per year in Brazil, being half of the cases in hospital settings[3].

Data related to in-hospital CA survival are used for clinical audits, to assess professional development and to determine if new resuscitation techniques are effective. The increase in survival rates depends on a rigorous investigation about the efficacy of critical interventions made during basic and advanced life support[4].

In accordance with the last guidelines publication about resuscitation from the American Heart Association (AHA), there is considerable evidence of the variation in incidence and in about CA results reported in different regions of United States. This variation points to the need to register each treated CA occurrence and assess the results, the continuous quality improvement depends on systematic assessments and feedbacks[5].

In-hospital CA incidence is rarely reported in the literature. Values vary between one and five events per 1.000 hospitalizations, or 0.175 events/bed per year. Survival reports of discharge vary from 0% to 42%, the most common interval is between 15% and 20%. According to the same authors, prognostic pre-arrest factors as sepsis, cancer and kidney failure are associated with smaller survival, however, tens of variables still have not been prospectively assessed as instruments to prevent the flaw of not surviving after the event[6].

In June of 1990, representatives of the American Heart Association (AHA), the European Resuscitation Council (ERC), the Heartand Stroke Foundation of Canada (HSFC) and the Australian Resuscitation Council (ARC) participated of a meeting, organized in Utstein, Norway. The goal of this meeting was to discuss nomenclature problems in resuscitation and the lack of language standards in reports related to CA in adults outside the hospital. In a following meeting in December of 1990, in Surrey, England, the decision of using the term "Utstein-style" was made to standardize data reports of cardiac arrests outside hospitals[7].

This process of standardization continued with the inclusion of adult in-hospital resuscitation, within the international agreements for its registry[8].

This information has contributed with a better comprehension of the resuscitation practice and, it facilitated progress in the direction of the published guidelines by ERC and AHA. The Utstein style model has helped with the standard communication of cardiac arrests[9].

A study[10] showed the association between certain clinical and demographic characteristics of patients presenting CA that are resuscitated and a better survival chance. However, until the moment, there is no efficient prognostic model to subsidize health professionals. All these aspects supports the relevance of the need for new studies to try to clarify the prognostic value of main CR variables and its consequences on immediate results and in long term, the resuscitation[10].

According to another study published in Spain, although CA treatment results are considered a quality indicator, it lacks official data about it in their country. Most studies conducted and published are concentrated

on arrests outside the hospital and have been describing varying results of incidence and survival, with discharge rates varying from 2,3% to 30%. The lack of knowledge about in-hospital arrests is even greater, with a very scarce number of published studies[11].

In Brazil, we also neede to fall back on international statistics, as the data from Cardiopulmonary Resuscitation National Registry, conducted between 2000 and 2002 in USA, with 14.720 CAs in adults, in 207 hospitals. It was demonstrated that 44% of in-hospital CA adult victims had spontaneous circulation return, and 17% survived until hospital discharge[12].

Data from studies in this area can offer useful aids to health professionals involved in the front line with patients potentially severe and/or at risk for sudden death, and therefore, with possible resuscitation, to be able to decide when to start and when to abandon resuscitation efforts in a CA[13].

Considering the revelance of the subject, the objective of the present study was to identify available evidence in the literature about CA in-hospital survival.

METHODS

We conducted an integrative review of the literature, a study that offers fast access to relevant results of studies and to thevevidence that grounds conducts or decision making, propiciating a critical knowledge[14].

The following steps were performed: establishing the hypothesis or research question, sampling or literature search, categorizing studies, assessing studies included in the review and interpretation of results[14].

The research question, or guiding question, was built through the PICO strategy, which guides the construction of a research question and the literature search. It allows the researcher, when having a doubt or a question, to find the best scientific information available in an accurate and fast way[15] (Chart 1). After using the PICO strategy, the question consisted of: what is the scientific evidence available in the literature related to in-hospital CA survival?

Chart 1: Building a guiding question through the PICO strategy.

P (Patient or problem)	Adult patients victims of in-hospital CA.
I (Intervention)	Performing the CR.
C (Control or comparison)	Comparison will be between CA survival rates in different environments and hospital settings.
O (Outcomes)	CA survival rate.

The search of indexed publications was performed in June of 2014, in the following electronic databases: PUBMED, LILACS and SciELO.

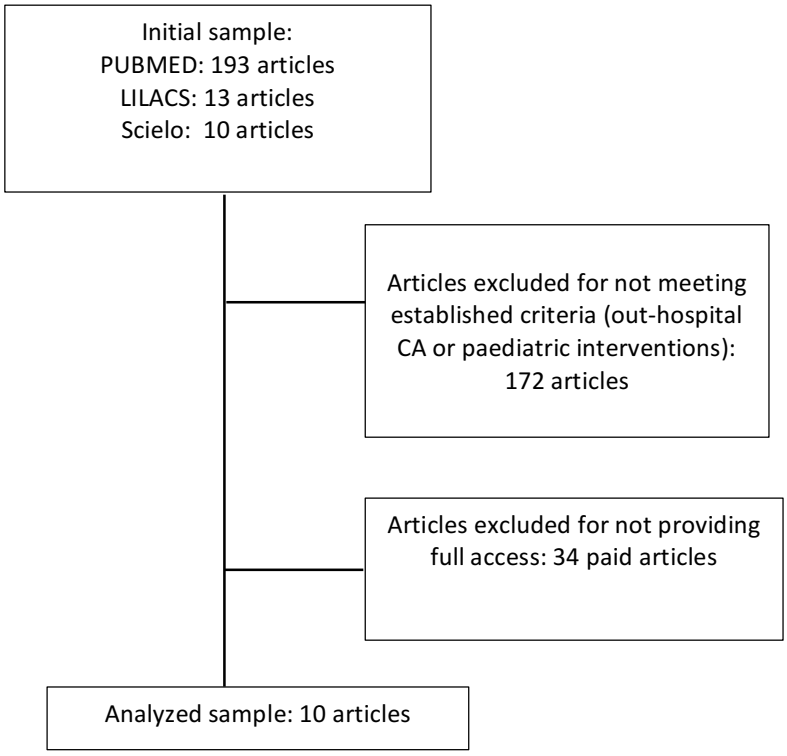
To search studies we used the following descriptors: “Cardiac Arrest”, “Cardiopulmonary resuscitation” and “Survival”, and its combinations in Portuguese, English and Spanish, with the term “AND” as Boolean operator, establishing the time period of 2010 to 2014. Investigation since 2010 is justified because at this year, the International Liaison Committee on Resuscitation (ILCR), an entity that aggregates the main resuscitation organizations in the world, established new Guidelines for Cardiopulmonary Resuscitation.

Inclusion criteria were: studies published in English, Spanish and Portuguese, during 2010 tp 2014. Exclusion criteria were: studies involving out-hospital CA situations, interventions in paediatric patients and studies with no full-text available.

To systematize articles found through the search, authors defined an instrument containing: authorship, title, year, journal, language, country of origin, study’s nature, study’s object and goals, subjects, main results regarding cardiorrespiratory arrest in-hospital.

We observed a large number of out-hospital CA studies, and with paediatric interventions, which were excluded from this review.

Figure 1: Fluxogram of study selection where in-hospital CA is the object.



After reading and analyzing the studies, we opt to pool them in 3 groups:

1. Analysis of survival rates in institutions: n°2, 5 and 10;
2. Factors related to CA survival: n°1 - it related in-hospital Automatic External Defibrillator (AED) use and survival; n°3 – it related Body Mass Index (BMI) and survival; n°4 – it looked at the relationship between survival and women in childbearing age; n°6 – it related survival and hospital participation on a CA registry; n°7 – it related duration of resuscitation efforts and survival;
3. Improvements in survival rates over time (years): n°8 and 9;

RESULTS

The Chart 2 presents the articles selectioned in the review.

Chart 2: Synthesis of articles by authors, title, journal, year, study design, research findings, and use of Utstein Style registers.

Author. Title. Journal. Year	Study Design	Research Findings	Did it use Utstein Style registries during data collection?
Chan et al. Automated External Defibrillators and Survival After In-Hospital, Cardiac Arrest. JAMA. 2010[16]	Cohort	Study with 11.695 patients, from 204 hospitals, 82,2% had CA caused by defribrillation-susceptible cardiac rhythms, AED was used in 38,6%, the use was associated with a lower survival rate (P <0,001).	Yes
Marmaj et al. Reporting on data from cardiopulmonary resuscitation. Anaesthesiology Intensive Therapy. 2010 [17]	Observational, descriptive	Study with 38 patients victims of CA, 84% caused by non-defribrillation-susceptible cardiac rhythms. ERC was reached in 45% (67% of defribrillation-susceptible cardiac rhythms), it was concluded that the CA mechanism determined survival chance in-hospital.	Yes
Jain. al. Body Mass Index and Survival After In-Hospital Cardiac Arrest. Circulation Cardiovasc Quality and Outcomes. 2010[18]	Observational, descriptive	21.237 patients were assessed for CA caused by defribrillation-suceptible cardiac rhythms. Low, normal weight and heavly obese patients presented lower rates of survival until discharge, CA caused by non-defribrillation-susceptible cardiac rhythms presented survival until discharge between BMI groups, except for low weight patients.	Yes
Topjian et. al. Women of Child-Bearing Age Have Better In-Hospital Cardiac Arrest Survival Outcomes than Equal Aged Men. Critical Care Medicine. 2010[19]	Observational, prospective	Using the database from the CA National Registry, with 519 hospitals and 95.852 patients, it was concluded that agebearing women are more susceptible than men of comparable age to survive to discharge after CA in a hospital, even after arrest control of etiology and other important variables.	Yes
Yokoyama et. al. Report From the Japanese Registry of CPR for In-Hospital Cardiac Arrest (J-RCPR). Circulation Journal Official Journal of the Japanese Circulation Society. 2010 [20]	Observacional, prospective	Study conducted in 12 hospitals, with 491 adult patients. Prevalence of VT/FV without pulse was 28,1%, asystole of 29,5%, and pulseless electrical activity of 41,1%. Immediate event causes were: arrhythmia 30,6%, acute respiratory insufficiency 26,7%, hypotension 15,7%. SCR was 64,7; and survival after 24h after CA was 49,8%, the proportion of survival for hospital discharge was 27,8% and the proportion of favorable neurological result in 30 days was 21,4%.	Yes
Bradley et. al. Duration of hospital participation in Get With the Guidelines-Resuscitation and survival of in-hospital cardiac arrest. Resuscitation. 2012 [21]	Observational, prospective	Used data from 362 hospitals of a database registry and program to improve the quality of assistance to in-hospital CA. From the 104,732 patients, 16,9% survived until discharge. It was concluded that duration of hospital participation in the program was significantly associated with survival of the event, but not survival until hospital discharge. In CA by VT/FV, this association could be mediated by improvements in time for defibrillation.	Yes
Goldberger et al. Duration of resuscitation efforts and subsequent survival after in-hospital cardiac arrest. Lancet. 2012 [22]	Observational, prospective	A study with 64.339 patients with CA in 435 hospitals. The proportion of patients who reached REC was 48,5% and 15,4% survived to discharge. Those hospitals with longer trials had a higher likelihood of SCR and survival to discharge, especially when CA is due to asystole and pulseless electrical activity (PEA).	No
Möhnle. Survival after Cardiac Arrest and Changing Task Profile of the Cardiac Arrest Team in a Tertiary Care Center. The Scientific World Journal. 2012 [23]	Observational, retrospective	CA treated from 2004 to 2006 were retrospetively analyzed, and the characteristics of patients and events were compared to a previous analysis similar in 1995 and 1997. After CR, survival rate to discharge was 30,2% on the years 2004 to 2006, in comparison to 25,1% on the years 1995-1997 (not statistically significant). Survival after one year was 18,5%.	Yes
Shin et al. Improving Survival Rate of Patients with In-Hospital Cardiac Arrest: Five Years of Experience in a Single Center in Korea. Journal of Korean Medical Sciences. 2012 [24]	Observational, retrospective	A total of 958 patients with in-hospital CA were assessed between 2005 to 2009. It was reported that in-hospital survival improved gradually.	Yes
Chan et al. Long-Term Outcomes in Elderly Survivors of In-Hospital Cardiac Arrest. The New England Journal of Medicine. 2013[25]	Observational, retrospective	A study with 6,972 adults who received hospital discharge after surviving a CA between 2000 and 2008. Among the elderly survivors, 60% were alive after 1 year, survival rate in 3 years was similar between patients with cardiac insufficiency. Survival rates and re-admission were different in accordance with demographic characteristics and neurological condition at discharge.	Yes

Regarding year of publication, four articles were published in 2010 (40%), one in 2011 (10%), other four in 2013 (40%) and only one article was published in 2014 (10%). Although studies were from 2010 to 2014, data from all included studies were collected in previous years, demonstrating the lack of recent studies about the theme. Regarding the journals, there was no more than one study in each. When assessing study designs, there was only one cohort study (10%) and nine observational ones (90%).

DISCUSSION

Studies 2 and 5 analyzed CA survival rates in different institutions, study 5 presents data of a large multicenter registry conducted in Japan. Defribrillation-suceptible cardiac rhythms were 28,1% against 16,0% in study 2, conducted in a general hospital in Polony. Non-defribrillation-suceptible cardiac rhythms in study 5 were 70,6% against 84,0% in study 2. SCR was 64,7%, against 45,0% respectively. It is observed that CA determines survival chances in-hospital[17-20].

Study 10, conducted in United States, analyzed elderly in-hospital CA survivors, at hospital discharge 51,9% had moderate to severe neurological impairement, were in coma or in vegetative state. One year after discharge, only 58,5% of survivors were alive[25].

A major variation in survival rates between studies was observed. These data, in consonance with the literature available in the field, demonstrate differences in CA survival between institutions, reinforces the need of more research and the identification of factors that contribute with CA survival. Neurological impairments and disorders after CA are also findings that incentivize broadening of savailable cientific knowledge not only in a sense to improve survival percentages, but also for quality of life.

Among studies that tried to find survival associated factors, study 1 associated AED use and in-hospital CA survival. Within non-defibrillation-susceptible rhytms, AED use was related to lower survival, and in cases of defibrillation-susceptible rhytms, its use was associated with increased survival. The study concludes that AED use in patients admitted with CA is not associated with increase in survival[16].

Yet, study 3 related BMI of patients submitted to resuscitation and survival. For CA caused by defibrillation-susceptible rhytms, underweight, normal weight and heavly obese patients, presented lower survival rates until discharge. In contrast, for CA caused by non-defibrillation-susceptible rhytms, survival was similar between groups, with exception of underweight[18].

Study 4 identified women at childbearing age being more likely than men at comparable age to survive to discharge after in-hospital CA, even after controlling for etiology and other important variables. This survival benefit was not present for women ≥ 56 years (post-menopause) in comparison with men at the same age[19].

Study 6 used the GWTG-R, a data registry and a program to improve quality of in-hospital CA. From 104.732 patients, 17.646 (16,9%) were discharged, 19,5% of events were during the first year of hospital participation in the registry, 18,3% in the second year, 15,8% in the third; 13,1% in the fourth, 10,5% in the fifth, 8,3% in the sixth, 6,4% in the seventh, 4,9% in the eighth, and 2,6% in the nineth. The duration of hospital participation in the registry was significantly associated with survival of in-hospital[21].

Study 7 evaluated the proportion of patients who reached immediate CA survival, which was 48,5%. From those 15,4% were discharged. Patients of hospitals with longer resuscitation trials (average of 25 minutes) presented higher probability of SCR. Patients of hospitals with higher trials have higher probability of SCR and survival until discharge[22].

In the search for variables related to CA survival, there is a variety of factors to be studied, although it is still small the number of large and varying studies for each one of items, difficulting comparisons. Factors as childbearing age for women, continuous registries of CA and duration of resuscitation, which demonstrated higher

survival rates, still need more discussions and in depth research.

Study 8 compared survival rates after CR during 1995 to 1997 and 2004 to 2006. After CR, survival rates to discharge were 30,2% in 2004 to 2006, and 25,1% in 1995 to 1997. Survival after one year was 18,5%. Yet, study 9 retrospectively assessed CR registries of a university hospital in South Korea, between 2005 to 2009. A total of 958 patients with in-hospital CR were assessed and improvements for in-hospital survival was observed[23-24].

Although being few, large studies comparing survival rates of actual CA with previous years, these already demonstrated improvements in results. This fact could be due to the gradual increment in research in the field.

From the ten included studies, nine used standardized Utstein style registries, guaranteeing improvements in data quality and demonstrating evolution in CA scientific research.

Although included studies were published between 2010 and 2014, there are no statistics for this period, all are based in previous years, and there is not many information about the period after the publication of the last American Heart Association Guidelines.

CONCLUSION

The integrative review allowed the construction of a scientific synthesis about the knowledge produced on the last five years about in-hospital CA. Results pointed large knowledge gaps and absence of national studies about the subject, therefore more research is needed. Studies analyzed here presented divergent designs, difficulting comparison. On the other hand, all used Utsein Style registries in their data collection, contributing for information of better quality.

Although resuscitation success depends on diverse and complex factors, many times individual CA research have been bringing important advances and being able to improve success rates. Studies demonstrated that survival to CA events have been gradually increasing on the last years. We believe that this is due to research conducted and consequently, adequation of assistance protocols.

Support to more publications on this theme is of fundamental importance, especially of in-hospital CA, that is less studied and more complex when compared to out-hospital. Measures to increase survival rates should be based in broad and well designed studies, describing success factors and its limitations, aiming to improve work processes and to obtain better survival results with less harm possible to the patient.

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