Review article

Incidence and outcome from adult cardiac arrest occurring in the intensive care unit: A systematic review of the literature

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ABSTRACT

Background: Significant amount of data on the incidence and outcome of out-of-hospital and in-hospital cardiac arrest have been published. Cardiac arrest occurring in the intensive care unit has received less attention.
Aims: To evaluate and summarize current knowledge of intensive care unit cardiac arrest including quality of data, and results focusing on incidence and patient outcome.
Sources and methods: We conducted a literature search of the PubMed, CINAHL and Cochrane databases with the following search terms (medical subheadings): heart arrest AND intensive care unit OR critical care OR critical care nursing OR monitored bed OR monitored ward OR monitored patient. We included articles published from the 1st of January 1990 till 31st of December 2012. After exclusion of all duplicates and irrelevant articles we evaluated quality of studies using a predefined quality assessment score and summarized outcome data.
Results: The initial search yielded 794 articles of which 780 were excluded. Three papers were added after a manual search of the eligible studies' references. One paper was identified manually from the literature published after our initial search was completed, thus the final sample consisted of 18 papers. Of the studies included thirteen were retrospective, two based on prospective registries and three were focused prospective studies. All except two studies were from a single institution. Six studies reported the incidence of intensive care unit cardiac arrest, which varied from 5.6 to 78.1 cardiac arrests per 1000 intensive care unit admissions. The most frequently reported initial cardiac arrest rhythms were non-shockable. Patient outcome was variable with survival to hospital discharge being in the range of 0–79% and long-term survival ranging from 1 to 69%. Nine studies reported neurological status of survivors, which was mostly favorable, either no neurological sequelae or cerebral performance score mostly of 1–2. Studies focusing on post cardiac surgery patients reported the best long-term survival rates of 45–69%.
Conclusions: At present data on intensive care unit cardiac arrest is quite limited and originates mostly from retrospective single center studies. The quality of data overall seems to be poor and thus focused prospective multi-center studies are needed.

Contents

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1. Introduction

Cardiac arrest (CA) is a major health problem and survival from cardiac arrest depends largely on prompt initiation of cardiopulmonary resuscitation. Cardiac arrest occurring in the intensive care unit (ICU) represents a specific sub-group, which differs in several ways from cardiac arrests occurring outside the hospital or in other areas of the hospital. Vital functions of patients treated in the intensive care unit are monitored continuously and the risk of unwitnessed arrests is low.[1,2] The delay to initiation of cardiopulmonary resuscitation (CPR) is likely to be short which should result in better chances for survival.[1,2] Advanced resuscitation, including invasive treatment options and differential diagnosis of cause of cardiac arrest are readily available in the ICU. On the other hand pre-existing conditions and severity of illness are likely to have a negative impact on survival. Data on out-of-hospital (OHCA) and in-hospital cardiac arrest (IHCA) are accumulating but data on incidence and outcome of intensive care unit cardiac arrest (ICUCA) are scarce, and appear to be of a highly variable quality. The aim of the present study was to systematically review the literature on ICUCA with focus on demographics, incidence and outcome of ICUCA. We sought to evaluate the quality of the included studies with pre-defined quality criteria.

2. Methods

2.1. Sources and methods

We performed a literature search in January 2013 using PubMed, CINAHL and Cochrane Database of Systematic Reviews (1.1.1990–31.12.2012), using the following medical subheadings (MeSH): "heart arrest" AND "intensive care unit" OR "critical care" OR "critical care nursing" OR "monitored bed" OR "monitored ward" OR "monitored patient". In addition we manually searched all references of selected articles for cross-references. In the process of selection of literature and data extraction PRISMA statement and PRISMA checklist were followed.[3]

2.2. Selection

Following the initial search three authors independently (JNU, MSK, MCA) screened articles for further analysis based on the article title and/or abstract when available. After that one author (IEF) reviewed full texts of selected articles and performed an exclusion of duplicates and studies meeting our exclusion criteria. We excluded studies conducted in the pediatric population, studies limited to reporting CA occurring in coronary care or high dependency units and studies that focused primarily on other subjects than ICUCA patients such as studies focusing on ICU care of out-of-hospital and in-hospital cardiac arrest patients. Inclusion criteria for the studies were: studies focused on ICUCA, adult population, studies reporting data on ICUCA outcome and/or incidence.

2.3. Data extraction

We reviewed all eligible articles independently in order to extract all relevant data, such as year of publishing, type of study, study setting, patient profile, ICU characteristics, cardiac arrest etiology, duration of resuscitative efforts, incidence, mortality, neurologic and long-term outcomes. We made no attempt to contact the authors in order to confirm or to obtain additional data.

2.4. Quality score

We developed a quality assessment score (Table 1) in order to evaluate methodological quality of the selected articles. According to the scoring table a score of 0 would indicate poor quality and

Table 1
Evaluation criteria for methodological quality of the included studies.

Evaluation criteria	Points, max 22

1. Study type
    Focused prospective study (4 points)
    Prospective resuscitation registry (3 points)
    Prospective ICU registry (2 points)
    Retrospective (1 point)
	4

2. ICU definition/staffing reported	1
3. General ICU/patient profile outlined	1
4. Cardiac arrest incidence: cardiac arrest/ICU admission	2
5. Cardiac arrest clearly defined	1
6. Initial arrest rhythm reported	1
7. Cardiac arrest etiology reported	1
8. Initial ICU admission diagnosis	1

9. Time intervals (1 point each)
    Time to initiation of CPR
    Time to ROSC
	2

10. Reporting of clinical factors found to correlate with the occurrence of cardiac arrest (e.g. changes in physiological parameters, acute illness scoring systems, etc.)	1

11. Outcome data (1 point each)
    24 h survival
    ICU discharge
    Hospital discharge
    Long-term survival (minimum 180 days)
	4

12. Neurological outcome (1 point) or quality of life (1 point) after hospital discharge	2
13. Data on special resuscitation techniques and unconventional treatment strategies (e.g. open-chest CPR)	1

ICU, intensive care unit; CPR, cardiopulmonary resuscitation; ROSC, return of spontaneous circulation.