



Review

Meta-analysis of outcomes of the 2005 and 2010 cardiopulmonary resuscitation guidelines for adults with in-hospital cardiac arrest[☆]



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ABSTRACT

Objectives: The post-cardiac arrest survival rate has remained low since the 2010 cardiopulmonary resuscitation (CPR) guidelines were published. The present study aimed to review the 2010 vs 2005 CPR guideline outcomes in adults with in-hospital cardiac arrest.

Methods: The Pub Med, EMBASE, and Cochrane Library databases were searched for articles published between January 2006 and July 2015. We extracted the following from observational studies and intervention studies: first author's name, publication year, study duration, age of study population, and sample size. The primary outcome variables were return of spontaneous circulation (ROSC) and survival to discharge. The data were divided into 2005 (data collected before December 2010) and 2010 (data collected in December 2010 or later) CPR guidelines groups.

Results: Twenty-four original articles (77,605 patients) were included. Statistically significant heterogeneity (ROSC: $P < .01$, $I^2 = 97.9\%$; survival to discharge: $P < .01$, $I^2 = 98.3\%$) was seen, and a random-effects model was used to pool the outcomes. The pooled ROSC rate for the 2010 group ($n = 5$; mean, 48%; 95% confidence interval [CI], 0.38–0.58) was only slightly higher than that of the 2005 group ($n = 19$; mean, 47%; 95% CI, 0.38–0.57). The opposite result was noted in the pooled survival to discharge rates (2010: $n = 5$, mean, 14%; 95% CI, 0.08–0.20 vs 2005: $n = 19$; mean, 15%; 95% CI, 0.10–0.20). There was actually no significant difference in ROSC or survival to discharge outcomes between the 2 groups.

Conclusions: The 2010 CPR guidelines emphasized that high-quality chest compressions can increase the ROSC rate but did not show to improve long-term results.

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1. Introduction

The 2010 cardiopulmonary resuscitation (CPR) guidelines published by the American Heart Association especially emphasized the use of high-quality chest compressions during CPR. The most significant adult basic life support (BLS) change in this document is its recommendation of a compressions, airway, breathing sequence instead of the airway, breathing, compressions sequence of the 2005 guidelines to minimize delays to the initiation of compressions and resuscitation [1].

However, the effect of high-quality CPR on survival has rarely been prospectively assessed in a randomized trial. One study reported that the CPR protocol of the 2010 guidelines was associated with a higher proportion of patients achieving return of spontaneous circulation (ROSC), but this did not translate to statistically significant

improvements in survival to discharge or neurologically intact survival in adults with in-hospital cardiac arrest receiving CPR by an emergency team [2]. However, in children, the CPR intervention research according to the 2010 CPR guidelines was associated with a trend toward improved survival to hospital discharge and favorable neurological outcome but not ROSC [3]. Improved trends in survival to hospital discharge and neurological outcomes occurred in cases of both shockable and nonshockable arrest rhythms from out-of-hospital cardiac arrest between October 2005 and December 2012 [4]. With the increasing rate of dispatcher-assisted bystander CPR, significantly improved survival and neurological outcomes also occurred in cases of metropolitan out-of-hospital cardiac arrest with the bystanders trained according to 2010 CPR guidelines [5].

Survival outcomes after resuscitation were associated with age, electrocardiography rhythm, the timing of cardiac arrest, where CPR was performed, and the duration of CPR [6]. Adults had more frequent ROSC, 24-hour survival, and survival to discharge than children from in-hospital CPR in emergency department during 2000 to 2010 [7].

It is unknown whether the recent improvements are due to the new 2010 guidelines or to an increased number of trained bystanders or other reasons. Recent meta-analyses of cardiac arrest research have

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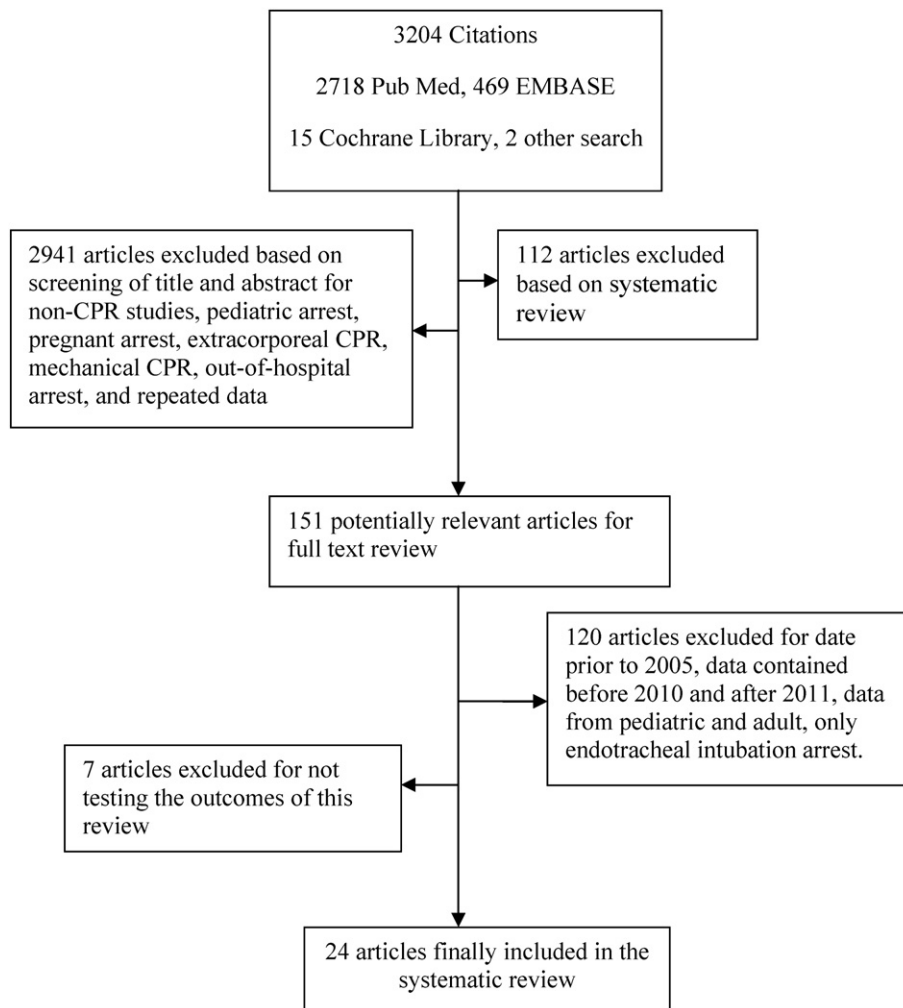


Fig. 1. Literature search data.

focused on the use of new therapies including mechanical chest compression [8], extracorporeal CPR [9] and defibrillation [10], new medications such as adrenaline [11] and antiarrhythmics [12], or resuscitation training [13]. However, no group has conducted a systematic review to precisely assess the outcomes of the 2010 CPR guidelines. Usually, out-of-hospital CPR is performed by a bystander and subject to availability of first aid equipment, whereas in-hospital arrests receive CPR by trained health care workers with minimal delay and immediately available equipment. We decided to focus on in-hospital rather than out-of-hospital arrests because the environment is more similar between studies so results would more likely relate to the 2010 vs 2005 guidelines. Therefore, the goal of this study was to summarize and perform a meta-analysis of the 2010 vs 2005 CPR guidelines in a population of adults with in-hospital cardiac arrest.

2. Methods

2.1. Search strategy

A systematic review of the literature was based on the meta-analysis of observational studies in epidemiology statement. Relevant studies were identified from Pub Med, EMBASE, and Cochrane Library searches using the following terms: (outcome of in-hospital cardiopulmonary resuscitation [MeSH Terms]) OR (outcome after in-hospital cardiopulmonary arrest [MeSH Terms]) AND adult. Limits: Only studies of humans within the defined time frame (January 1, 2006, to July 31, 2015) were included.

First, the first author selected studies based on the titles and abstracts, and then, the 2 authors respectively screened the full texts of the remaining articles more thoroughly. Disagreements were settled by consensus or adjudication of the 2 authors.

The following eligibility criteria were required for inclusion: (1) observational or intervention study, (2) publication after 2006 with data sources 2006 or newer, (3) in-hospital arrest, (4) *adult population* (defined as >14 years), (5) survival data available, and (6) publication in English. We excluded studies of (1) CPR performed or started in the out-of-hospital setting; (2) CPR performed in the operating room; (3) data combining arrests in both children and adults; and (4) CPR performed in a special population, including pregnant women, patients requiring extracorporeal CPR or mechanical resuscitation, or arrest of a patient who is already intubated.

2.2. Data extraction

In addition to study design, patient characteristics, and sample size, we extracted information including actual numbers of survivors and corresponding cohort sizes and event rates. ROSC and survival to discharge were the primary outcome variables, but we also obtained data on survival at 24 hours and favorable neurological outcomes. If survival to discharge data were not available, we considered 30-day survival as survival to discharge.

The data were divided into the 2005 and 2010 CPR guidelines groups. The data collected before December 2010 were entered into the 2005 group; those thereafter were included in the 2010 group.

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