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Review article

The association of gasping and outcome, in out of hospital cardiac arrest: A systematic review and meta-analysis☆

Lianxing Zhao, Chunsheng Li*, Bo Liu, Miaomiao Wang, Rui Shao, Yingying Fang

Department of Emergency Medicine, Beijing Chao-Yang Hospital, Capital Medical University; Beijing Key Laboratory of Cardiopulmonary Cerebral Resuscitation (No. BZ0370), 8# Worker's Stadium South Road, Chao-Yang District, Beijing 100020, China

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ABSTRACT

Objective: Gasping is common after cardiac arrest, and its frequency decreases over time. The aim of this study was to conduct a meta-analysis to evaluate the association of gasping and survival to discharge in patients who suffered out-of-hospital cardiac arrest.
Methods: Relevant studies were identified by searching in PubMed, Medline, Embase, OVID, Web of Science and Google Scholar. Risk ratios (RR) and 95% confidence intervals (CI) were calculated to assess the association of gasping and on out-of-hospital cardiac arrest outcomes. Heterogeneity, subgroup analysis, sensitivity analysis and publication bias were explored.
Results: Individual patient data was obtained from 10,797 participants suffered out-of-hospital cardiac arrest in five cohort studies of 4 articles. A fixed effects model suggested that patients with gasping were 3.525 times (95% CI: 3.028–4.104; $P < 0.01$) more likely to survive to discharge than those without gasping, and there was no heterogeneity among studies ($P = 0.564$). Also it may be a favorable factor for return of spontaneous circulation (RR: 2.170; 95% CI: 1.691, 2.785) with high heterogeneity ($Q = 5.26$; $P = 0.022$).
Conclusions: Findings of this meta-analysis demonstrated that gasping is common after cardiac arrest, and is associated with increased survival to discharge. Patients who are cardiac arrest with gasping should be promptly resuscitated.

Introduction

Out-of-hospital cardiac arrest (OHCA) is a worldwide public health problem, which usually causes high mortality. Although many efforts have been made, the outcomes are still poor. The aggregate survival rate of OHCA is only 7.6%, and it has been stable for almost 30 years.[1] There are lots of factors identified affecting the outcomes of OHCA, including witnessed events, bystander cardiopulmonary resuscitation, emergency medical system arrival time, initial rhythm, the interval time of defibrillation[1,2] and so on. Among these factors, one called gasping has been valued by researchers recently.

After the onset of cardiac arrest (CA), spontaneous respiratory activity is an important phenomenon,[3] and lots of terms can be used to describe it such as agonal breathing, agonal respirations, abnormal breathing and gasping. By layperson, it is described to be barely breathing, labored breathing, gurgling, snorting, moaning or groaning.[4] The definition of agonal respiration could be adopted from medical dictionaries as "pertaining to or occurring at the time just before death"[5] or "relating to the process of dying or the moment of death, so called because of the erroneous notion that dying is a painful process".[6] Gasping is a ventilatory movement, which makes an abrupt, sudden, and transient effort, resulting in brief inspiration and expiration with a longer expiratory pause.[7,8]

Gasping is common in out-of-hospital cardiac arrest, immediately when patients sustain sudden cardiac arrest. The incidence, etiology, physiology and effect of gasping have been studied in many animal models.[9–12] However, articles about human were limited, because of medical ethics, most were reviews and editorials,[3,13–20] and the others were observational cohort studies with short term outcomes including return of spontaneous circulation (ROSC) and survival to discharge.[2,4,21–23] To get a more precise estimation, we performed a meta-analysis of the association between gasping and outcomes of out-of-hospital cardiac arrest.

☆ A Spanish translated version of the summary of this article appears as Appendix in the final online version at http://dx.doi.org/10.1016/j.resuscitation.2015.09.377.

* Corresponding author.
E-mail address: lcscyyy@163.com (C. Li).

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Methods

Search strategy

The Pubmed, Medline, Embase, OVID, Web of Science and Google Scholar were searched to identify all studies involving cardiac arrest and gasping up to December 2014. Terms used for the searching were "out-of-hospital", "cardiac arrest", "gasping", "agonal breathing", "agonal respiration", "cardiopulmonary resuscitation" and "CPR". "Related Articles" option and list of references were also used to identify additional studies.

Selection criteria

All studies were selected by two independent reviewers according to the following criteria: (a) studies involving out-of-hospital cardiac arrest, comparing clinical outcomes between patients with and without gasping; (b) clinical outcomes of interest were ROSC and survival to discharge; (c) full paper could be obtained; (d) sufficient published data for estimating the risk ratio (RR) with 95% CI; (e) for duplicate publications, the largest or most recent publication was selected; (f) the subjects were human; (g) studies published in English.

Studies were excluded if we could not get sufficient data for pooling or could not get additional data by contacting authors twice.

Quality assessment

The Newcastle-Ottawa Scale[24] was used to assess the quality of a selected study. This tool consists of eight items in three forums including crowd selection, comparability, exposure assessment and outcome evaluation. It evaluates the quality of a literature using a semi-quantification principle star system, which is out of 9 stars. A maximum of two stars can be given for comparability.

Data extraction

Data were extracted by two independent reviewers from each eligible study. The requested information included the first author's name, publication year, country, type of recordings, study design, the total number of patients suffered CA, the number of patients suffered CA with or without gasping, and the number of patients who did or did not have outcomes of interest among with and without gasping groups were also extracted.

Statistical analysis

The association of gasping and CA outcome was estimated for each study by risk ratio (RR) along with its 95%CI. The pooled RR and 95%CI were calculated by the fixed-effect model using the Mantel Haenszel method[25] when heterogeneity was not present ($PQ \geq 0.1$ or $I^2 \leq 50\%$), otherwise random-effect model using the Dersimonian and Laird method[26] ($PQ < 0.1$ or $I^2 > 50\%$). Subgroup analysis was used to explore the sources of heterogeneity. Influence of individual study on the pooled RR was estimated by reestimating and plotting in the absence of each study. Publication bias was assessed using a funnel plots and the Egger's linear regression test. All the analyses were performed using Stata version 12.0, with two-side $P < 0.05$ considered statically significant. Heterogeneity was assessed using the Q-test[27] based on Chi-square or I^2 statistic test.

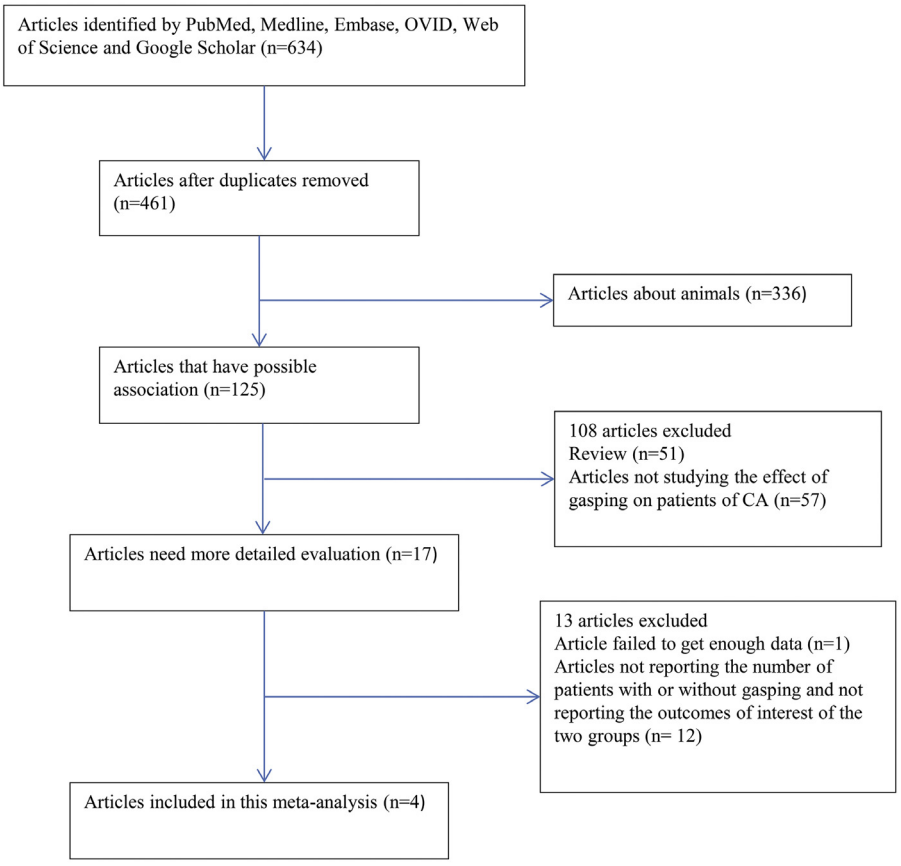

Fig. 1. Flow of selection articles.