

Systematic Review Snapshot

TAKE-HOME MESSAGE

Irrespective of presenting rhythm, in patients with cardiac arrest there is no conclusive evidence that administration of calcium during cardiopulmonary resuscitation (CPR) improves survival.

METHODS

DATA SOURCES

A literature search using PubMed, National Library of Medicine, EMBASE, Cochrane Database, and the AHA Endnote Master Library was used with both Medical Subject Headings and free-text terms. Further studies were collected by searching references listed of articles.

STUDY SELECTION

This review was conducted to update the Guidelines on Cardiopulmonary Resuscitation and Emergency Cardiac Care, using the 2010 International Liaison Committee on Resuscitation (ILCOR) evidence evaluation process. Forty-eight articles were retrieved but only 10 included. Each included article matched one of the 5 levels of evidence reported by ILCOR (Table). Editorial articles, abstracts, reviews, commentaries, and guidelines were excluded.

DATA ANALYSIS AND SYNTHESIS

When data were available, the authors evaluated relative risk, relative risk reduction, absolute risk reduction, and number needed to treat in individual studies. After studies were assigned to one of the 5 levels of evidence, the evidence

Does Calcium Administration During Cardiopulmonary Resuscitation Improve Survival for Patients in Cardiac Arrest?

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Results

Table. Levels of evidence and quality of 10 studies supporting, opposing, or neutral to calcium administration during CPR from cardiac arrest.*

	Level of Evidence				
	1	2	3	4	5
Quality of study					
Evidence supporting					
Poor					Kay and Blalock ¹
Evidence neutral					
Fair	Stueven ^{2,3}				
Poor		Gando ⁴	Harrison and Amey ⁵		
Evidence opposing					
Fair		Stueven ⁶	Urban ⁷		
Poor					Meuret ^{8,9} Blecic ¹⁰

*Level of evidence 1: Randomized controlled trials or meta-analyses of them. Level of evidence 2: Pseudo-randomization or meta-analyses of such studies. Level of evidence 3: Retrospective controls. Level of evidence 4: No control group. Level of evidence 5: Studies not directly conducted on the targeted population/patient.

Forty-eight articles were retrieved; 12 articles were selected, but of these, 2 pediatric studies were not included in the ILCOR evaluation process because of age requirements. Therefore, 10

studies were included in the ILCOR submission, and the quality of each study was classified as nothing better than fair. Of the 10, only 2 by Stueven et al^{2,3} were blinded randomized trials

was classified as supporting, opposing, or neutral and the quality of study was further rated as good, fair, or poor.

and therefore level of evidence 1. Seventy percent of studies were human studies and sample size varied from 4 to 480 patients. No study had conclusive evidence that could support recommendations about use of calcium during cardiac arrest.

An additional 4 studies were included in the review but not the ILCOR submission and therefore are not found in the Table. These 4 studies either did not report return of spontaneous circulation during CPR or failed to demonstrate improved outcomes for patients receiving calcium.¹¹⁻¹⁴

The authors of the review stated that they evaluated a statistical analysis of the relative risk, relative risk reduction, absolute risk reduction, and number needed to treat of using calcium; however, none of these quantitative data are presented in the review. Further, of the 10 studies presented in the Table, none of the abstracts or articles mentioned any results related to the relative risk, relative risk reduction, absolute risk reduction, or number needed to treat for using calcium during cardiac arrest. It is unclear which articles were analyzed, what the data exactly showed, and how they influenced the authors of the review.

Commentary

The first published guidelines for the management of patients by advanced cardiac life support (ACLS) were developed by the American Heart Association in 1974,¹⁵⁻¹⁷ who initially recommended calcium salts for treatment of cardiac arrest. However, these guidelines had no references to support this recommendation. Since then, there have

been revisions about the indications of calcium in patients with cardiac arrest.¹⁸⁻²¹ In 2005, the American Heart Association and European Resuscitation Council published the lack of data and potential harm of calcium during CPR. The guidelines state that calcium should be used in cases of hyperkalemia, hypocalcaemia, or calcium channel blocker intoxication but fail to clarify whether these 3 indications remain for patients in cardiac arrest.^{22,23}

There are 2 broad types of studies included in this review by Kette et al.¹⁷ One category consisted of investigators who tested the correlation between acidosis and hypocalcemia. The theory is that in cardiac arrest, acidosis causes hypocalcemia, and reversal of this electrolyte imbalance may lead to viable cardiac function. However, there was no evidence to support improved survival or even return of spontaneous circulation in this patient population.^{4,7,24} The second category explored effects of calcium administration during cardiac arrest with different presenting cardiac rhythms. It was shown that there was no benefit of calcium, in either human or animal studies, in restoring cardiac function during cardiac arrest. Furthermore, it was shown that calcium even as a last resort is not effective, possibly because mortality and time in cardiac arrest patients are directly correlated.

Since 1974, there has been limited progress on defining the role of calcium in ACLS. One of the largest limitations of this review is the lack of cohesiveness in the included studies. Only 2 studies were randomized controlled trials, and the remaining studies were both considered fair or poor in quality with lower level of evidence. There was a wide variation in sample size, presenting rhythms, use of medications given, reported data, and outcomes suggesting that calcium may be lifesaving, ineffective,

or harmful. With such variation, this leaves the results section as a summary of the individual studies versus a synthesis of all articles. Future studies should aim for randomized blinded controlled trials, larger sample sizes, and use of predetermined algorithms for interventions to help identify possible benefits or harms of calcium administration during cardiac arrest. Last, future studies should clearly list all pertinent quantitative data that may persuade the determination of clinical significance of calcium administration during cardiac arrest.

Editor's Note: This is a clinical synopsis, a regular feature of the *Annals'* Systematic Review Snapshot (SRS) series. The source for this systematic review snapshot is: Kette F, Ghuman J, Parr M. Calcium administration during cardiac arrest: a systematic review. *Eur J Emerg Med.* 2013;20:72-78.

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