**WORKSHEET for Evidence-Based Review of Science for Emergency Cardiac Care**

**Worksheet author(s)**
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Date Submitted for review: 10/20/09 (re-re-revision)

**Clinical question.**
PedS-028  “In pediatric patients with cardiac arrest (out-of-hospital and in-hospital) (including prolonged arrest states) (P), does the use of NaHCO3 (I) compared with no NaHCO3 (C), improve outcome (O) (eg. ROSC, survival)?”

**Is this question addressing an intervention/therapy, prognosis or diagnosis?** Intervention

**State if this is a proposed new topic or revision of existing worksheet:** Revision (update). The C2005 worksheet for this topic actually did not review any papers as the search found none specific to pediatrics.

**Conflict of interest specific to this question**
Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet? NO

**Search strategy (including electronic databases searched).**

**Pubmed**
1. Sodium bicarbonate  
   9167  
2. Cardiac arrest  
   40962  
3. Sodium bicarbonate AND cardiac arrest  
   262  
4. Limit sodium bicarbonate AND cardiac arrest to “all child”  
   39

**Cochrane Central Register of Controlled Trials**
1. Sodium bicarbonate  
   370  
2. Cardiac arrest  
   395  
3. Sodium bicarbonate AND cardiac arrest  
   5  
4. Pediatrics  
   273  
5. 3 and 4  
   0

**Embase**
'sodium bicarbonate' OR 'bicarbonate'/exp AND 'heart arrest'/exp AND (([newborn]/lim OR [infant]/lim OR [child]/lim OR [adolescent]/lim) AND [humans]/lim  
122

**State inclusion and exclusion criteria**
Exclusion: adult and neonatal (at time of birth) unless recent RCTs (since 2005 COSTaR); studies not in peer-reviewed journals (i.e. abstracts only);

studies that did not address the question; case reports

Inclusion: pediatric studies that are relevant to question after review of each reference identified in search

**Number of articles/sources meeting criteria for further review:**
3
### Summary of evidence

#### Evidence Supporting Clinical Question

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**Level of evidence**

A = Return of spontaneous circulation  
B = Survival of event  
C = Survival to hospital discharge  
D = Intact neurological survival  
E = Other endpoint  
*Italics = Animal studies*
### Evidence Neutral to Clinical question

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A = Return of spontaneous circulation  
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*Italicics* = Animal studies

### Evidence Opposing Clinical Question

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*Italicics* = Animal studies
Despite ongoing clinical use of sodium bicarbonate in pediatric cardiac arrest, there is very limited data to support the practice. Since the 2005 science review, one large retrospective study (Meert, 2009, p. 544, LOE 4) found survivors were less likely to receive sodium bicarbonate than non-survivors. In a regression model using both pre and post-arrest data, and adjusted for age, gender, and first documented rhythm, sodium bicarbonate was associated with increased hospital mortality. This effect, however, did not persist in two other regression models performed as part of the study.

A recent RCTs in neonates (Lokesh, 2004, p. 219, LOE 5), with respiratory arrest at the time of delivery room demonstrated no benefit from sodium bicarbonate on survival or immediate neurologic outcomes. Another recent RCT in adults (Vukmir, 2006, p. 156, LOE 5) with out of hospital cardiac arrest demonstrated no change in survival. A small subgroup with patients in cardiac arrest over 15 minutes had improvement in survival, but in this study, survival was only defined as emergency department survival. Because of the inherent differences in adult vs. pediatric cardiac arrest populations, caution is appropriate when attempting to apply this data to children.

There is insufficient data to make a recommendation for change in the use of sodium bicarbonate. Given the incidence of hypoxic, hypercarbic respiratory arrest as a cause of pediatric cardiac arrest population and the paucity of data, caution is warranted in providing a therapy that increasing CO2 load, as does sodium bicarbonate. The one new pediatric study, while not establishing a causal relationship, demonstrates no benefit and suggests worse outcomes. Most studies are confounded by worse outcomes being associated with longer arrests, and the increasing frequency of bicarbonate use in longer periods of cardiac arrest.

Acknowledgements:

Citation List

A randomized controlled trial of sodium bicarbonate in neonatal resuscitation-effect on immediate outcome.


Level 5 (neonatal, at birth population), Neutral, Fair Quality (small sample size)

Comment: This small study (55 total patients) from Chandigarh, India examined the newly born not in cardiac arrest, but were still requiring positive pressure ventilation five minutes after birth (respiratory arrest). Although there are some differences in pediatric cardiac arrest and asphyxiated infants with ongoing respiratory arrest after birth, this small study is helping is showing there is not a huge impact of the use of bicarbonate on the outcome variables analyzed. While it may not be adequately powered to detect small differences, it adds to the depth of the literature suggesting bicarbonate is not useful in this setting.

Multicenter cohort study of in-hospital pediatric cardiac arrest.


Level 4, Fair Quality (retrospective database review designed to answer a different question), Opposing
Comment: Retrospective review from the 15 Pediatric Emergency Care Applied Research Network sites with
353 in-hospital cases. Sodium bicarbonate was used in 49.4% of survivors vs. 70.6% of non-survivors,
(P<0.01). In a regression model using both pre and post-arrest data, and adjusted for age, gender, and first
documented rhythm, sodium bicarbonate was associated with increased hospital mortality. The retrospective
design of this report limits the generalization of the findings.

Sodium bicarbonate improves outcome in prolonged prehospital cardiac arrest.


Level 5 (adult population), Neutral, Fair Quality (survival only assessed as emergency department survival)
Comment: In this adult out of hospital cardiac arrest study (OOHCA) from the University of Pittsburgh, early
administration of bicarbonate was not associated with an overall change in survival. While there was no overall
survival benefit, an increase in survival was seen in the subgroup of arrests over 15 minutes, although the
actual numbers of patients in this subgroup was quite small (27 total, 18 survivors in the bicarbonate group vs.
9 in the control group). Caution is warranted in considering adult cardiac arrest data in developing pediatric
recommendations, as sudden cardiac death is a common cause of adult OOHCA, but a rare cause of arrest in
children. Given the frequency of airway and respiratory etiologies of pediatric cardiac arrest, caution in
extrapolating this adult data is warranted.