Characteristics of Pediatric Cardiac Arrest Differ by Setting

Source: *Moler FW, Meert K, Donaldson AE, et al. In-hospital versus out-of-hospital pediatric cardiac arrest: a multicenter cohort study. Crit Care Med. 2009;37(7):2259-2265; doi:10.1097/CCM.0b013e3181a00a6a*

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Question: Among children who have had cardiac arrests, is there a significant difference in the circumstances and prognosis when cardiac arrest occurs in-hospital versus out-of-hospital?

Question type: Descriptive

Study design: Retrospective cohort study

To better understand the characteristics and outcomes of children who suffer a cardiac arrest either in-hospital (IH) or out-of-hospital (OH) the authors conducted a multi-center retrospective cohort study between 2003 and 2004. The authors reviewed medical records of children between the ages of 24 hours and 18 years who experienced a cardiac arrest requiring at least one minute of chest compressions with return of spontaneous circulation for at least 20 minutes, treated at one of 15 hospitals associated with the Pediatric Emergency Care Applied Research Network (PECARN).[1] Cardiac arrests were characterized as OH if chest compressions were initiated before hospital arrival and IH when chest compressions were initiated anywhere in the hospital setting. Arrest etiology was classified as cardiac (not congenital heart disease), congenital heart disease, respiratory, neurologic, drug ingestion, trauma, electrolyte imbalance, or terminal condition.

The study population included 353 children with IH and 138 with OH arrest. Those with IH arrests were significantly younger (median 0.9 vs 2.9 years), more likely to have a chronic condition (88% vs 49%), more likely to have bradycardia (49% vs 10%) and less likely to have asystole (16% vs 46%) on their first monitored rhythm. The majority of IH arrests (73%) were due to congenital or acquired heart disease while the majority of OH arrests (72%) were due to respiratory disease.

In the 12 hours after arrest, the IH group had significantly more invasive monitoring (arterial and central venous catheters), use of ECMO (17% vs 2%), and were more often administered steroids (25% vs 5%). Minimum body temperature was lower among victims of OH arrest (34.1° C vs 35.3° C) but maximum temperature in the initial 12 hours after arrest was also higher in this group (37.8° C vs 37.1° C). OH arrest patients had significantly lower initial blood pH values (7.03 vs 7.20) and higher maximum glucose values (291 vs 195 mg/dL). The OH group was more likely to have seizures within the first 12 hours (26% vs 14%), absence of normal pupillary response (68% vs 25%), and death (62% vs 55%), and less likely to have survival with good neurologic outcome (24% vs 47%).

The authors conclude that children with IH versus OH arrest have significant differences in both etiology and outcome. A clinical study designed to assess the effectiveness of an intervention such as therapeutic hypothermia for cardiac arrest will require separate analysis.

Commentary by

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Dr Bratton has disclosed no financial relationship relevant to this commentary. This commentary does not contain a discussion of an unapproved/investigative use of a commercial product/device.

The overall survival in the present report by Moler, et al of 46% can lead to an overly optimistic view unless one takes into account that patients who did not have return of spontaneous circulation were excluded from the study. Survival after OH arrest is very poor[2] and, although low, survival after IH arrest has improved.[3] Nadkarni, et al found 25% survival when evaluating a large recent IH cardiac arrest cohort. Arrests in a monitored setting with established vascular access is associated with improved survival, while asystole as the initial presenting rhythm carries the worst chance of survival.[3] A somewhat new factor for survival is use of ECMO to support failed cardiovascular function after arrest[4] and as an adjunctive therapy for CPR.[5] Average survival after "failed" CPR rescued with ECMO is 38%.

Hypothermia has long been known to lower metabolic rate and been utilized for neurologic protection during repair of complex heart disease during cardiopulmonary bypass. The potential benefit for pediatric cardiac arrest remains unexplored. The authors highlight the heterogeneity of pediatric cardiac arrest demographic features and outcomes that will complicate a potential hypothermia study. A feature not mentioned by the authors is hypothermia dose, which is likely important for both efficacy and toxicity. Hypothermia causes arrhythmias and coagulopathy and in a recent study of pediatric severe traumatic brain injury was associated with hypotension and a trend for worse outcome.[6] These challenges are just some of the issues facing future studies of hypothermia after pediatric cardiac arrest.

References

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Key words: out-of-hospital cardiac arrest, in-hospital cardiac arrest, neurologic outcomes

AAP Grand Rounds™ is published monthly by the American Academy of Pediatrics, 141 Northwest Point Blvd., Elk Grove Village, IL 60007. **Postmaster:** Send address changes to *AAP Grand Rounds*, American Academy of Pediatrics, Customer Service Center, 141 Northwest Point Blvd., Elk Grove Village, IL 60007-0198.

ISSN Numbers
Print: 1099-6605
Online: 1556-362X

Customer Service and Renewals: (866) 843-2271.
Email Address: grandrounds@aap.org
Subscription Rates: AAP member $91/year; non-member $114/year (12 issues), including up to 18 *AMA PRA Category 1 credit(s)*˜.

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