

OPTIMAL PREHOSPITAL CARE FOR CHILDHOOD CARDIAC ARREST

A. SPECIFIC AIMS

1. Introduction

There is very little evidence to guide the optimal prehospital treatment for children who suffer cardiac arrest outside of hospital and to improve upon their extremely poor survival and morbidity. Each year in the U.S., 15,000 children collapse and lose effective heartbeat (cardiac arrest) outside of hospital and 95% of them will not survive to leave hospital alive. Of those who do survive, physical and cognitive disabilities are common and severe. If a child suffers cardiac arrest outside of hospital and does not receive immediate and effective treatment, we believe that he/she has very little chance of survival or of going home without significant disability. The four links in the American Heart Association (AHA) Adult Chain of Survival for prehospital treatment of cardiac arrest have been well studied in adults, in part due to the large Canadian Ontario Prehospital Advanced Life Support (OPALS) Study. Very little research has been done for the analogous Pediatric Chain of Survival, which has different priorities than for adults. Much is now known, for adults, about the relative value of cardiopulmonary resuscitation (CPR) by citizen bystanders, optimized defibrillation programs by first responders, and advanced life support (ALS) measures by the Emergency Medical Services (EMS) paramedic providers. Prehospital ALS measures include airway management, intravascular access, and drug therapy. Unfortunately, very few methodologically sound studies have been conducted regarding management of prehospital pediatric cardiac arrest, particularly prior to arrival at hospital. It is accurate to say that very little is known about the best timing, intensity, and duration of EMS treatment for this problem. There are considerable barriers to conducting methodologically robust clinical studies *outside of hospital*, for *children* who have suffered *cardiac arrest* and careful planning is required in order to research important unanswered questions about prehospital management.

2. Overall Goal

The overall goal of our group is to improve the survival and morbidity of pediatric patients who suffer cardiac arrest outside of hospital. The goal of this Clinical Trial Planning Grant proposal is to allow our research team to **plan a definitive multicenter clinical trial** that would evaluate the best timing, intensity, and duration of prehospital life support interventions for these children.

Needs Statement: We need to design and conduct a large, methodologically robust study in order to optimize prehospital treatment of pediatric cardiac arrest and achieve the best possible survival, neurological, and rehabilitation outcomes.

With the current proposal, we intend to undertake a planning process and the collection of convincing preliminary data that will allow us to subsequently submit a proposal for a definitive multicenter clinical trial. In particular, we intend to resolve key feasibility and methodological issues that have traditionally prevented successful clinical research in an area where studies are very difficult to conduct. The largest barriers, to date, are inadequate sample size, poor quality data, obtaining research ethics approval, and determining the most important interventions. Members of our research group are responsible for conducting the OPALS Study, the largest controlled out-of-hospital study ever conducted worldwide, for adults. The OPALS Study is evaluating the timing, intensity, and duration of the second (early CPR), third (early defibrillation), and fourth (early ALS) links in the AHA Adult Chain of Survival but does not include pediatric patients and does not address the Pediatric Chain of Survival. To date, the OPALS Study has produced surprising and important results for adults regarding the value of bystander CPR, optimized community defibrillation programs, and the quality of life of survivors; final results regarding ALS are expected in 2003. Our research team has considerable experience in all the elements required to meet this goal: a) Design and conduct of large prehospital resuscitation clinical trials; b) Treatment of pediatric cardiac arrest; c) Biostatistics and data analysis; d) Health economic evaluations; and e) Quality of life and neurological outcome assessments.

3. Specific Aims

With regards to planning a large multicenter clinical trial for prehospital interventions in pediatric cardiac arrest, our four specific aims and the respective sub-aims are to:

1) Review And Interpret The Current Evidence

- a) Conduct a comprehensive **literature search** and synthesis of the present evidence,
- b) Identify the most important **unanswered issues** in prehospital treatment of pediatric cardiac arrest.

2) Identify Partners And Determine Feasibility

- a) Identify **partners** to serve as advisors and study sites,
- b) Determine **feasibility parameters**, i.e. number of sites, number of cases per site, and event rates.

3) Specify The Details Of The Methodological Approach

- a) Determine the optimal **study design**,
- b) Define patient **inclusion and exclusion** criteria,
- c) Determine the best approach to **research ethics** approvals,
- d) Specify the most important **interventions** to be evaluated,
- e) Identify all important **outcome measures**,
- f) Determine the best **data collection** and patient follow-up methods,
- g) Determine the **minimal clinically important difference** for the major outcome measures,
- h) Formulate specific **study hypotheses**,
- i) Determine the optimal approach to effectiveness **data analysis**,
- j) Determine the optimal approach to a **health economic evaluation**,
- k) Estimate an adequate **sample size**.

4) Plan The Study Organization

- a) Determine the optimal **data management** procedures,
- b) Determine appropriate **organizational issues**, i.e. structure of team, timeline, personnel, and budget.

4. Deliverables

We believe that our research team is uniquely positioned to provide strong evidence about how to best improve the outcomes of children whose heart stops beating outside hospital. We have a wealth of experience and knowledge about prehospital resuscitation research and pediatric cardiac arrest. We hope to replicate for children what the OPALS Study is doing to advance knowledge about out-of-hospital cardiac arrest in adults. The current project will allow us to conduct preliminary feasibility reviews at several potential study sites and to convene experts at several study planning workshops. At the end of this project we intend to submit a full research proposal to conduct a multicenter clinical trial that will evaluate several innovative approaches to improve outcomes after pediatric cardiac arrest. This process will, therefore, lead to the optimal timing, intensity, and duration of pediatric cardiac arrest interventions, lead to better survival, and ultimately improve the rehabilitation and quality of life of pediatric cardiac arrest patients.