PEDiatric EARLY DEFIBRILLATION
KIDS AND CARDIAC ARREST

“Conventional” Wisdom

- Pediatric cardiac arrest (CA) is very rare.
- Kids don’t have ventricular fibrillation (VF).
- Kids have bradycardia that degrades into asystole.
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“Conventional” Wisdom

- Cardiac arrest in kids is always caused by airway or breathing problems.
- Aggressive support of the airway, breathing, and circulation (CPR) is the best therapy until advanced cardiac life support arrives.
The Facts

Kids DO have cardiac arrest!
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The Impact

• Children constitute less than 10% of all cases of attempted out-of-hospital resuscitation.

• However, the death of a child is an enormous emotional and social loss with a community-wide impact.

• *Because of their life expectancy, the number of years of life lost as a result of pediatric arrests may rival that for all adult arrests.*

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Data Incomplete

• Reports vary on the frequency of SCA in the population less than 8 years of age.

• Data is obscured by poor reporting methods and the lack of ECG recordings from pediatric patients.
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Data Incomplete

• 44 studies between 1970 and 1997 on pediatric patients receiving CPR.
• Only 8 studies included > 100 patients. Term “arrest” was defined in only 33 studies, definition varied.
• Term “pediatric” or “child” was defined in only 20 studies.
• 14 different outcomes were reported.
• Follow-up was incomplete.

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What We Know

• SCA in children does not occur as frequently as it does in adults, but it is not rare.

• An estimated 16,000 children die each year in the U.S. of unexpected pediatric cardiopulmonary arrest.¹

• Approximately 50% of pediatric cardiac arrests occur in children < 1 year of age.²

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What We Know

• One study reported VF as the first identified rhythm nearly 20% of the time (excluding SIDS).¹

• Out-of-hospital survival from cardiac arrest ranges from 4% to 9%.²

• Many survivors have significant neurological deficits due to long down time.

• However, when VF is promptly treated (within < 10 minutes), survival statistics rival those of adults.¹,²

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What We Know

Incidence of VF in Children

The percentage of 0-4 year old SCA patients with VF is comparable to that of 15-19 year olds (for whom AEDs are currently indicated).

Overall average: 19%

“Ventricular fibrillation is not rare in child and adolescent pre-hospital cardiac arrest.”

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What We Know

- Excluding SIDS, the causes of pediatric cardiac arrest are evenly distributed among medical illnesses, overdoses, drowning, and trauma.

- The most frequent cause associated with VF as first identified rhythm was cardiac.

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What We Know

- Airway management and rescue breathing alone are not enough when a respiratory arrest degenerates into cardiac arrest.

- No improvement in survival over last decade,\(^1\) despite intense focus on improving oxygenation, ventilation.\(^2\)

- The appropriate treatment for pediatric cardiac arrest caused by VF is defibrillation.

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The EMS Story

• EMTs are often limited to CPR while awaiting paramedic arrival, wasting precious time.

• Most pediatric cardiac arrest patients are in asystole or other non-treatable rhythms by the time paramedics arrive.

Courtesy AAA Foundation for Traffic Safety
KIDS AND CARDIAC ARREST
The EMS Story

• The current standard of care for early defibrillation is to utilize an AED on children 8 years or older.

• Many EMS protocols limit AED use to patients 12 years or older.

Courtesy Cleveland County EMS
In one study, 55% of pediatric cardiac arrest patients did not receive defibrillation by the first responder because, *per protocol, defibrillation was delayed awaiting paramedic arrival.*

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The EMS Story

• Paramedics are most often the first EMS providers to identify the patient’s heart rhythm.

• Because average paramedic response time is over 8 minutes in most EMS systems, little ECG data is available for the critical first 5 minutes of pediatric cardiac arrest.

Courtesy AAA Foundation for Traffic Safety
KIDS AND CARDIAC ARREST
The EMS Story

• VF may be even more prevalent than previously shown. Because first responders could not use AEDs on pediatric patients under 12 yrs, ECG monitoring delayed. VF may have “come and gone” by then.

• Author’s conclusion: AED technology must be altered to allow for early defibrillation of pediatric patients.

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Barriers to Pediatric Early Defibrillation

- Until recently, AEDs were not cleared for use on children <8 years/55 pounds.
- Device issues included:
  - simplicity of use
  - appropriate energy level
  - accuracy of ECG analysis algorithm
- Lack of knowledge on the part of EMS providers and physicians.
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Pediatric Early Defibrillation with the FR2

Unmistakable pads connector contains attenuation circuitry

50 J delivered through small pads placed A/P for small torsos

Adult AED with standard 150 J output

Let's make things better.
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Pediatric Early Defibrillation with the FR2

Pediatric Attenuated Defibrillation Pads

- Pediatric pads attenuate (reduce) energy of the FR2 AED to a level appropriate for children 0-8 years.
- One AED for all ages by simply changing the pads.
- Ease of use for infrequent responders.

Let's make things better.

PHILIPS
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Pediatric Early Defibrillation with the FR2

Unmistakable Pads and Package: Easy for Stressed Responder

Let's make things better.
KIDS AND CARDIAC ARREST
Pediatric Early Defibrillation with the FR2

Why 50 joules?

• Sufficient energy effective at the top end of the age range, where an 8 year old, 25 kg patient receives a 2 J/kg dose.
• And safe at the lower end, where a 3.5 kg newborn receives a 14 J/kg dose.

(Note that current guidelines allow delivery of up to 360 J from monophasic adult AEDs to 8 year old patients, resulting in a dose of up to 14 J/kg.)
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Pediatric Early Defibrillation with the FR2

FDA Clearance

- 40 different study manuscripts, abstracts, guidelines and statistical documents presented for review.
- Studies by Cecchin\(^1\) and Tang\(^2\) demonstrated safety and efficacy of attenuated SMART Biphasic waveform and SMART Analysis.
- A post-market surveillance study is being conducted via creation of a global database.


“The development of this new pad and cable system for this AED is a very encouraging development that helps address the AHA’s safety concern about electrical ‘overdosing’ of infants and children….The results of this recent [Cecchin, et al.] study are highly encouraging and suggest that the rhythm detection of the AED tested may perform well when used to actually assess the cardiac rhythm of children.”

American Heart Association
Position Statement: “Use of AEDs on Small Children”
July 2, 2001
“One manufacturer has [clearance] for use of its defibrillator with special pediatric pads which deliver a fixed energy level of 50 joules. This machine would be preferable to a defibrillator delivering only ‘adult’ fixed doses in situations where children may require defibrillation and a fully adjustable defibrillator is unavailable or unsuitable.”

U.K. Resuscitation Council
Statement:
“The use of biphasic defibrillators and AEDs in children.”
www.resus.org.uk
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Support from Authorities

“The London Ambulance Service is delighted to see the development of this elegant additional piece of equipment which will allow our crews to use the biphasic AED not only for the treatment of adults but also, where necessary, infants and children. This represents a significant advance in patient care.”

Ms. Fionna Moore, Medical Director
London Ambulance Service NHS Trust
"We need to protect the most precious part of our society and that is our children. Pediatric-specific automatic defibrillation needs to be available wherever children are present and should be a part of the basic tools of all emergency response personnel. It is only then that we will save more children’s lives."

Dr. Frank Cecchin
Department of Cardiology
Children’s Hospital - Boston
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The Bottom Line

- Widespread use of AEDs on adults has improved survival from SCA.
- Kids haven’t received the same early defibrillation standard of care as adults.
- Evidence supports early defibrillation for children/infants with a pediatric-ready AED.
- FR2 pediatric pads provide an easy to use solution for pediatric early defibrillation.