Effecting Neurologically-Intact Survival for Children with Out-of-Hospital Cardiac Arrest

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**The 4 Inevitabilities of Life**

- Death
- Taxes
- Kale
- Disclosures

**Very Early Interest in Mouth-to-Mouth ...**

*As an Infant, Paul Pepe Conducted Oral Explorations of the Universe...*

**Introduction**

**Pediatric Out-of-Hospital Cardiac Arrest (POHCA):**

- Grim Survival Chances Nationwide
- POHCA Intimidating for Most Rescuers:
  - Infrequent Use of Pedi ALS Skills, Volatile Setting, Psychological Challenge, Kids Often Easy to Carry ...
- **As a Result:**
  - Scoop & Run Practices Have Evolved
In Addition …

- Conventional Wisdom: “Don’t Intubate”
- “Respiratory” Cause -- Focus on Breathing
- So Routinely See R.R. >> 6 / minute
- First Dose of Epinephrine Delayed
- Some Observational Studies (e.g. NIH ROC) Now Indicate Better Outcomes Associated with Increased Scene Time

What Would Happen If We Now Focus on On-Scene Care?

Hypothesis

- Neurologically-Intact Survival for Children Could Be Improved by Deferring Transport and Prioritizing On-Scene Care …
  - By Using Strategies That Expedite On-Scene Drug Delivery and Intubation with Tightly-Controlled Ventilation …
  - And Training with Supportive Psychological Components and Strategies for Family Interactions
Methods

Setting: > County-Wide Fire-Based EMS System
  > Residential Population: 642,000 (87th most populous)
    (18% < 14 yo; 72% White, 21% Hispanic, 15% Black; Median Income $43K)
    >50% College/Graduate School; 70% in Homes vs. Multi-Unit Residence

Tools: > Utstein-Registry - Prospective Collection
  (January 1, 2012 through April 30, 2017 = 5.33 years)

** Throughout All Phases of Study, Protocols Adhered to the 2010 American Heart Association Guidelines

What Did We Do?

Interventions:
  • 2012: Traditional POHCA Care (i.e. very limited scene time)
  • 2014: Prioritized On-Scene Resuscitation (phase I A’s)
    that Expedited Drug Delivery via Direct I-O & Intubation (controlled ventilation rates ~6/min)
  • 2016: Began Techniques to Dose/Prepare Drugs Before Arriving On-Scene (phase II A’s)

... No other relevant modifications were made system-wise.
Primary Outcomes Studied...

Neuro-Intact Survival Rates in 2012-2013 (Phase 0, Traditional Approach, Pre-△’s)
...Were Compared to Phase I (2014-2015)
...Then Compared to Phase II (2016-2017)

Results?

RESULTS

- EMS Crews Managed 143 Consecutive POHCA Cases Over the 5.33-Year Study with Majority Presenting in Asystole. Including Those Eventually Resuscitated.
- Among Those Resuscitated Patients, the Time Interval from Medic Arrival On-Scene to the 1st Epi Dose Contracted From 16.5 min (2012-2013) to 7.3 min (2014-2015) to 5.0 min (2016-2017)
- Successful Intubation and I-O Insertions Were Regularly Performed In Much Greater Frequency On-Scene in Phase I & II But No Other Significant Differences in Terms of Age, Sex, Etiology, Response Times or Sequence of Drug Infusions.
Pediatric Cardiac Arrest Survivors
Two Years Before - and Two Years After - the Training/Protocol Change

2012 - 2013
2/56 No Survivors

2014 - 2015
13/56 Survived Intact
17/56 ROSC

p = 0.0006

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Pediatric Cardiac Arrest Survivors

2012 - 2013
No Survivors

2014 - 2015
13/56 Survived Intact

2016 - 2017
17/49 Survived Intact

p < 0.0001

Epi @ 5.0 min
5.0 min

Epi @ 7.3 min
7.3 min

Epi @ 16.5 min
16.5 min
Conclusions

Although a historically-controlled study...
The Sudden and Sustained Appearance of Neuro-Intact Pedi Cardiac Arrest Survivors ...
...Was Profound, Immediate & Rewarding

Much of this Appeared to be Attributable to:

Techniques That Expedited Care and a Disciplined Focus on Physiologically-Sound Respiratory Management and System-1 Thinking for Rapid Medication Dosing

Conclusions (cont.)

• We Also Believe That Major Contributors Were:
  1) Supportive Encouragement from Leadership
  2) Training with Specialized Psychological Tools
  3) Reinforced Encouragement from Successes

Thank You!!
Bystander CPR

• 2012-2013: 18 of 38 cases
• 2014-2015: 30 of 56 cases
• 2016-2017: 25 of 39 cases

\[(p = NS)\]

(Obvious) Conclusion:

"With the exception of 'Moonstruck', Nicholas Cage movies were apparently so bad that many people drowned themselves (by falling into a pool) .... ... Further study is needed"
Reclused or widowed by nature, many venomous arachnids typically funnel their energies by continuous monitoring of national spelling competitions on "the web" (using itsy bitsy devices). However, the somewhat furry critters will kilobyte (KB) humans beings when the spelling bee uses the longer words. Such words are not only harder to spell, but spiders also use their legs to memorize letters when spelling. If $n > 8$, they can spin out of control.

... Of course, no further study is needed"