#### **Resuscitation Outcomes Consortium**

#### Large Randomized Trial of Continuous vs. Interrupted Chest Compressions In Out-of-Hospital Cardiac Arrest: Resuscitation Outcomes Consortium (ROC) CCC Trial

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#### JOURNAL of MEDICINE

ORIGINAL ARTICLE

#### Trial of Continuous or Interrupted Chest Compressions during CPR

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### **Presentation & Publishing**

- Results previously presented at AHA Resuscitation Science Symposium, November 2015
- Results published in the New England Journal of Medicine, November 2015



### **Study Sites**

- Multicenter clusterrandomized trial
- Resuscitation
  Outcomes Consortium
  - 9 Regional Clinical Coordinating Centers
  - 114 EMS agencies





### **Study Funding Partners**

NIH National Heart, Lung and Blood Institute



Institute of Circulatory and Respiratory Health of the Canadian Institute of Health Research







Heart and Stroke Foundation of Canada



American Heart Association



### Participating UTSW/BioTel EMS Agencies











## **Objectives**

- To understand why this study was conducted
- To explain the major results of the study
- To suggest how EMS systems may utilize this study to determine how providers should perform CPR.





#### Higher Survival with Continuous than Interrupted CPR

Outcome	Before N=218	After N=668	Adjusted Odds Ratio (95% Cl)
ROSC	15.6%	23.1%	1.3 (0.8, 2.0)
Survival to Hospital Admission	16.1%	16.9%	0.8 (0.5, 1.2)
Survival to Hospital Discharge	1.8%	5.4%	3.0 (1.1, 8.1)

- Bobrow JAMA 2008
- 3 cycles of 200 compressions @ 100/min, then rhythm analysis
  - Single shock
  - No post-shock pulse check or rhythm analysis
  - IV epi 1 mg
  - Passive oxygenation or BVM
  - Deferred endotracheal intubation
- <u>Observational data</u> not randomized



### Background

- CPR consists of:
  - Chest compressions
  - Ventilations
- Chest compression interruptions may reduce blood flow
- Strategies to mitigate interruptions
  - Asynchronous ventilation without stopping chest compressions



#### Previous Observational Studies of Continuous Chest Compressions

- Bobrow, JAMA 2008
- Large improvements in survival to discharge
- Limitations
  - Before-after design non-randomized
  - No verification of actual CPR treatment
  - No CPR process measurement
  - Multiple simultaneous interventions
  - Low baseline survival
- Improvements may have been due to:
  - Improved CPR performance
  - Concurrent system improvements
  - Hawthorne effects



### **Study Objective**

 To PROSPECTIVELY compare the effectiveness of continuous vs. interrupted chest compressions in EMS provider CPR upon outcomes after out-of-hospital cardiac arrest.









#### Protocol – CCC vs. ICC



Early IV/IO, Epinephrine or Vasopressin within 5 minutes

## **Study Monitoring**

- CPR process measured by cardiac monitors
  - PhysioControl, Zoll, Philips
- EMS agency performance monitored by study monitoring committee





### **Outcome Measurements**

- Primary
  - Survival to Hospital Discharge
- Secondary
  - Favorable neurologic status at discharge
  - Adverse events





### **Estimated Sample Size**

#### Estimated <u>N=23,600 patients</u>

- 11,800 per group
- 90% power
- Detect absolute difference in survival to discharge of 1.3%
  - 8.1% vs 9.4%



### **Trial Enrollment**



#### **Pre-Treatment Patient Characteristics**

Patient Characteristic	CCC N=12,653	ICC N=11,058
Age, mean (SD)	66.4 (17.2)	66.2 (17.0)
Male, %	63.5	64.4
Obvious Cause of Arrest, %	3.1	3.2
Public Location, %	14.2	14.8
Witness Status, %		
Bystander Witnessed	40.9	42.7
Not Witnessed	56.4	55.4
Bystander CPR, %		
Yes	46.9	47.1
No	53.1	52.9
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#### **Post-Treatment Patient Characteristics**

Patient Characteristic	CCC N=12,653	ICC N=11,058
Dispatch to first EMS arrival in minutes, mean (SD)	5.9 (2.5)	5.9 (2.6)
Dispatch to first ALS arrival in minutes, mean (SD)	9.0 (5.1)	9.0 (5.1)
Treated by ALS, %	97.1	97.1
First rhythm shockable, %	22.4	22.6
Endotracheal intubation attempted, %	56.9	58.1
Endotracheal intubation successful, %	84.0	84.6
Epinephrine dose in mg, mean <u>+</u> SD	3.8 <u>+</u> 2.0	3.8 <u>+</u> 2.1
Enrolled in ALPS trial, %	9.7	10.1
Hospital Hypothermia, %	54.4	52.8

### Outcomes

Outcome	CCC N=12,653	ICC N=11,058	Adjusted Difference (95% Cl)	P Value
ROSC at ED arrival, %	24.2	25.3	-1.1 (-2.4 to 0.1)	0.07
Admitted, %	24.6	25.9	-1.3 (-2.4 to -0.2)	0.03
Survival to discharge, %	9.0	9.7	-0.7 (-1.5, 0.1)	0.07
Discharged to home, %	6.7	7.2	-0.5 (-1.2, 0.2)	0.15
MRS ≤ 3, %	7.0	7.7	-0.6 (-1.4, 0.1)	0.09
MRS, mean (SD)	5.6 (1.3)	5.6 (1.4)	0.04 (0.0, 0.08)	0.04
Hospital-free survival (mean days - SD)	1.3 (5.0)	1.5 (5.3)	-0.2 (-0.3, -0.1)	0.004
Survival to discharge (Safety Population), %	9.1	9.6	-0.5 (-1.3, 0.2)	0.15

### **Treatment Differences by Site**



#### Differences in Survival Adjusted for Pre-Treatment Characteristics

Adjusted Difference 95% Cl	P Value
-0.6 (-1.3, 0.1)	0.09
-0.7 (-1.5, 0.1)	0.07
-0.7 (-1.5, 0.1)	0.07
-0.7 (-1.4, 0.1)	0.09
-0.6 (-1.4, 0.3)	0.18
-0.7 (-1.5, 0.0)	0.07
-0.7 (-1.5, 0.0)	0.07
-0.03 (-1.1, 0.4)	0.38
	Adjusted Difference $95\%$ Cl $-0.6 (-1.3, 0.1)$ $-0.7 (-1.5, 0.1)$ $-0.7 (-1.5, 0.1)$ $-0.7 (-1.4, 0.1)$ $-0.6 (-1.4, 0.3)$ $-0.7 (-1.5, 0.0)$ $-0.7 (-1.5, 0.0)$ $-0.7 (-1.5, 0.0)$

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### **Key Observation**

- CCC did not improve survival or neurologic status over ICC
  - No difference by site or CPR quality









### Strengths

- Largest cardiac arrest randomized trial
- Multiple participating EMS agencies
- CPR process data on >90% cases
- CPR consistent with contemporary practice guidelines





### Limitations

- Did not measure oxygenation or minute ventilation
- Did not mandate post-resuscitation care





### So, Now What???

In an accompanying editorial....

Dr. Rudolph Koster (Academic Medical Center, Amsterdam, the Netherlands) noted that based on recent observational studies, the latest 2015 AHA guidelines includes a new class lib recommendation that "it may be reasonable for EMS to initiate resuscitation with three initial periods of 200 continuous chest compressions with passive oxygen insufflations". He adds that this recommendation was not made in the concurrent 2015 guidelines from the European Resuscitation Council.

Koster suggests that "if the results of the current ROC study had been available, the guidelines committee might have decided to retain the previous recommendation to give chest compressions interrupted for ventilations and perhaps even to upgrade that recommendation to a class lla recommendation for EMS providers." He concludes with the question: "Should the AHA reconsider its recommendation?"

### As always, more shall be revealed...

Subgroup and additional data analysis is ongoing.





## Where Do We Go From Here?







### **Other Considerations**

## Is CCC:

- Easier to teach?
- Easier to perform?
- Does skill retention last longer?





### **Cardiac Arrest Medical Direction**

Medical Directors must determine whether to recommend 30:2 or Continuous Chest Compressions.







# Thank You for Your Attention !!!





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