Existential Fun Park...

Why Are You Here??

DON'T BELIEVE EVERYTHING YOU THINK
2013 Ways to Push the Resuscitation Envelope:

Go with the Flow
– The Sweet Spot, “Snappy” Concepts & Stutter CPR

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Chest Compressions

Critical to Resuscitation...
“Hands-Off” Interval

Yu et al. Circulation 2002; 106:368-72

% ROSC

Delay from Stopping CPR

0% 20% 40% 60% 80% 100%

% ROSC

3 sec 5 sec 15 sec 20 sec
Minimally Interrupted Cardiac Resuscitation by Emergency Medical Services for Out-of-Hospital Cardiac Arrest

Context  Out-of-hospital cardiac arrest is a major public health problem.

Objective  To investigate whether the survival of patients with out-of-hospital cardiac arrest would improve with minimally interrupted cardiac resuscitation (MICR), an alternate emergency medical services (EMS) protocol.

Chest Compression Rates During Cardiopulmonary Resuscitation Are Suboptimal
A Prospective Study During In-Hospital Cardiac Arrest

Benjamin S. Abella, MD, MPhil; Nathan Sandbo, MD; Peter Vassilatos, MS; Jason P. Alvarado, BA; Nicholas O’Hearn, RN, MSN; Herbert N. Wigder, MD; Paul Hoffman, CRT; Kathleen Tynus, MD;

Higher Chest Compression Rates Were Significantly Correlated with Initial Return of Spontaneous Circulation

Methods and Results—We developed and validated a handheld recording device to measure chest compression rate as a surrogate for CPR quality. A prospective observational study of adult cardiac arrests was performed at 3 hospitals from April 2002 to October 2004. Resuscitation teams were instructed to use a chest compression rate of 100 cpm. Chest compression rates were recorded in 30-second time segments. In 97 arrests, data from 813 minutes during which chest compressions were delivered were analyzed in 30-second time segments. In 36.9% of the total number of segments, compression rates were <80 compressions per minute. Compression rates >120 cpm were significantly correlated with survival in survivors and nonsurvivors, 90±17 and 79±18 cpm, respectively; P=0.0033).

Conclusions—In-hospital chest compression rates were below published resuscitation recommendations, and suboptimal compression rates in our study correlated with poor return of spontaneous circulation. CPR quality is likely a critical determinant of survival after cardiac arrest, suggesting the need for routine measurement, monitoring, and feedback systems during actual resuscitation. (Circulation. 2005;111:428-434.)

Key Words: cardiopulmonary resuscitation ■ death, sudden ■ heart arrest
Key Finding of Early Studies

**Figure 3.** Smoothing spline representing the incremental probability of survival corresponding to a linear increase in chest compression fraction.

Chest Compression Fraction Determines Survival in Patients With Out-of-Hospital Ventricular Fibrillation

**i.e., The More Time Medics Spend Doing Chest Compressions, Then the Better the SURVIVAL RATE!!**
NIH ROC: Besides Salaries for Expert Personnel to Capture the Data & Outcomes ...

DFR Acquired Monitoring Equipment: for example, the ability to Capture Sec. to Sec. Performance of CPR

.... Recorded and Measured on Computers!
## CPR 2006

### Interval Statistics

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<th>Time</th>
<th>CPR Ratio, %</th>
<th>Prompt CPR Ratio, %</th>
<th>Compr Ratio, %</th>
<th>Prompt Compr Ratio, %</th>
<th>Compr Rate</th>
<th>Compr/min</th>
<th>Vent Rate</th>
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CPR 2009
Following Feedback, Re-Training and... More Re-Training:

2006

2009
Grants help make Dallas County one of best places to suffer cardiac arrest

10:24 PM CST on Friday, February 26, 2010
By JASON ROBERSON / The Dallas Morning News

Public Health

Cardiac care gets a jolt

County goes from one of the worst to one of the best places for a heart to stop

Steven Shelley is grateful for a federal grant that helped Dallas County medics and firefighters save more cardiac arrest patients last year and send them back to work. After finishing a four-hour shift of moving...
### Impact on Dallas Area Outcomes

**Survival to Hospital Discharge**

**Between 2006 and 2011**

<table>
<thead>
<tr>
<th>City</th>
<th>Increase</th>
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<tbody>
<tr>
<td>Dallas</td>
<td>↑157%</td>
</tr>
<tr>
<td>Irving</td>
<td>↑57%</td>
</tr>
<tr>
<td>Mesquite</td>
<td>↑100%</td>
</tr>
<tr>
<td>Carrollton</td>
<td>↑376%</td>
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</table>
Push Hard – Push Faster !!!

A Message from our Sponsors…
Maybe Not !
'The Sweet Spot of CPR'
Compression Rates Between 100 - 120 /min
Independently Associated with Increased Survival After Out-of-Hospital Cardiac Arrest
ITD Study

Very Interesting Results …
No Advantage
In Survival Chances
from the ITD Itself ….

…But Another Study
(ITD combined with The ACD Pump) was
a positive outcome !!
Impedance Threshold Device
“ITD”

- 12 cm H$_2$O
Maybe Not Negative Study!
Active Compression--Decompression
ACD Device
Improved Long-Term Survival with Favorable Neurologic Outcome

- Survival to Discharge: 53% improvement (p=0.019)
- 1 Year Survival: 49% improvement (p=0.03)

Resuscitation Outcomes Consortium Data

“The Sweet Spot of CPR”

Compression Rates Between 100 -120 /min Independently Associated with Increased Survival After Out-of-Hospital Cardiac Arrest
The Patient Has a Fractured Fibula....
...on a Mild Sedative.... Can Go Home Tomorrow ..
Some Daring New Concepts
Vasodilators in Cardiac Arrest

Pushing Another Envelope in Resuscitation Science ....
Coronary Perfusion Pressure

“The Key Factor” in Achieving ROSC

(Return of Spontaneous Circulation)
Nitroprusside ??

for Cardiac Arrest ???
Sodium Nitroprusside (SNP)

• SNP Breaks Down in the Circulation and Releases Nitric Oxide
• Nitric Oxide Decreases Both Preload and Afterload
• So Giving Such a Vasodilator During CPR is Counter-Intuitive!
Until You Think of CPR in Terms of Better Coronary Flow – Not Better Coronary Pressure
ACD / ITD CPR

Increasing Flow !!
Experimental Protocol

15 min. of Untreated Ventricular – Fibrillation (VF)

SNP

2 mg

1 mg

SNPeCPR

(11 animals)

Epi 0.5 mg

6 min

Total of 15 min of CPR; if no ROSC, END of study

If ROSC, 24-hour observation

(11 animals)

SNPeCPR Trial

V-fib Induced

SNPeCPR Begun

AORTIC PRESSURES

15 minutes downtime (no CPR)
Overall Performance Category

<table>
<thead>
<tr>
<th>SNPeCPR</th>
<th>Standard CPR</th>
</tr>
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<tbody>
<tr>
<td>5 or dead</td>
<td></td>
</tr>
<tr>
<td>5: Coma or death</td>
<td></td>
</tr>
<tr>
<td>4: Major deficits</td>
<td></td>
</tr>
<tr>
<td>3: Moderate deficits</td>
<td></td>
</tr>
<tr>
<td>2: Minor deficits</td>
<td></td>
</tr>
<tr>
<td>1: Normal</td>
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</tbody>
</table>

Good neurological outcome
Can We Make SNPeCPR Even Better?
During Organ Transplant, Blood Flow is “Trickled”/Stuttered Back In to Prevent Reperfusion Injury

Might a Similar Strategy Work for Hypoxic Organs in Cardiac Arrest?
Would a More Controlled Reperfusion Better Protect the Heart & Brain after Cardiac Arrest with a Protocol That Initially “Stutters” CPR?

Hypothesis:

– 3 min of 20 sec On --- 20 sec Off CPR (called “stutter” CPR)

– Followed by “Enhanced CPR” (ACD-ITD)

– Along With Non-traditional Drugs (e.g. Adenosine)
• **Prolonged VF Downtime** (15 min)
  • Randomized as Follows:
    – Group 1 (n=8); S-CPR (Standard CPR)
    – Group 2 (n=8); SNPeCPR
    – Group 3 (n=8); SNPeCPR + High Dose Adenosine
    – Group 4 (n=8); SNPeCPR + High Dose Adenosine + Controlled Pauses (CP)

*All Got Epinephrine as Needed and Defibrillation Attempt*
15 Min of Untreated VF

2 mg SNP and 24 mg Adenosine

1 mg SNP
## Survival at 24 Hours ... 

<table>
<thead>
<tr>
<th>Group 1: Std-CPR</th>
<th>Group 2: SNPeCPR alone</th>
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</thead>
<tbody>
<tr>
<td>2/8 survived</td>
<td>7/8 Survived</td>
</tr>
<tr>
<td>None w/ good neuro @ 24 hrs:</td>
<td>3 w/ Good Neuro @ 24 hours:</td>
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</table>

<table>
<thead>
<tr>
<th>Group 3: SNPeCPR &amp; Adenosine</th>
<th>Group 4: SNPeCPR, Adenosine and STUTTER CPR</th>
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<tbody>
<tr>
<td>8/8 survived</td>
<td>8/8 survived</td>
</tr>
<tr>
<td>4 w/ good neuro @ 24 hours:</td>
<td>7 w/ good neuro @ 24 hours:</td>
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Conclusions

• Targeting Flow – Not Pressure – … In a More Controlled Manner … … May Improve Outcomes

Stay Tuned!
OVERALL CONCLUSIONS...
On the Road to the 22nd Century...
You mean you're still ALIVE!?
We’ll Make Life Better for Future Generations ....
Thanks !
People who find you on Facebook

- High School people you hated
- College people you hated
- Work colleagues you hate
- Actual friends