Taking the Guessing Out of Decompressing the Pressing: Post FDA Experience with ACD-ITD CPR

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Cardiac Output During S-CPR

Is all S-CPR the same?

Wide variations exist even in some of the best EMS systems (ROC data)
ACD CPR in Paris - 2000
ACD CPR Device - 2015
Compression Phase
Standard CPR (S-CPR) vs. ResQCPR™

Minimal expiratory resistance w/ResQPOD®
DE-compression Phase
Standard CPR vs. ResQCPR™

S- CPR – Passive Recoil
- Minimal change in intrathoracic pressure
- Small circulation

ResQCPR™ – Active Recoil
- ↓↓ intrathoracic pressure
- Preload increased →
  ↑↑ cardiac output
- ICP lowered →
  ↑↑ cerebral perfusion

Airway (Intrathoracic) Pressure

Ventilation

Chest Compressions

Passive Chest Wall Recoil

Active Chest Wall Recoil
Blood Flow to Heart and Brain
Porcine V-Fib Model

Survival to Hospital Discharge with Favorable Neurologic Outcome

ResQTrial (ACD+ITD CPR v S-CPR)

- Control (n = 813)
- Intervention (n = 840)

- 5.8% in Control: 47/813
- 8.9% in Intervention: 75/840

*53% improvement
p = 0.019
OR 1.58
CI (1.07, 2.36)
## ResQTrial: Major Adverse Events

<table>
<thead>
<tr>
<th>Adverse Event; n (%)</th>
<th>Control (N = 813)</th>
<th>Intervention (N = 840)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumothorax</td>
<td>7 (0.9)</td>
<td>10 (1.2)</td>
<td>0.628</td>
</tr>
<tr>
<td>Internal organ injury</td>
<td>2 (0.2)</td>
<td>4 (0.5)</td>
<td>0.687</td>
</tr>
<tr>
<td>Pulmonary edema</td>
<td>62 (7.6)</td>
<td>94 (11.2)</td>
<td>0.015</td>
</tr>
<tr>
<td>Chest fracture(s)</td>
<td>15 (1.8)</td>
<td>12 (1.4)</td>
<td>0.563</td>
</tr>
<tr>
<td>Aspiration</td>
<td>7 (0.9)</td>
<td>8 (1.0)</td>
<td>1.000</td>
</tr>
</tbody>
</table>
A funny thing happened on the way through the FDA...
Finally!
Implementing ResQCPRTM
Implementing ResQCPR™

Training and retraining

the physiology is not intuitive

“One and done” is not enough in CE

Tracking outcomes

ROSC, neurological awakening, complications

What should be expected?

Factor the yearly cardiac arrest per EMT and/or Paramedic in your system

Your system may treat 1300 arrests/year, but if there are 4200+ EMS personnel...
- Bend at waist
- Use upper body and thighs to compress and lift.
- 50% compress
- 50% decompress
Force Gauge & Metronome

Purple area guides LIFTING forces.

Green area guides COMPRESSION forces.

Bottom of red arrow at ZERO indicates no lift or compression being applied.

80 NOT a natural rate for EMS.
Active Compression

- Similar depth as conventional CPR—2 inches (or ~5 cm)
- Note amount of force needed to compress to 2 inches
- Use bottom of red arrow
- Approximate amounts of force needed:
  - Soft chest: ≈30 kg
  - Average chest: ≈40 kg
  - Stiff chest: ≈50 kg
- ≤ 40 kgs should be sufficient for most
Optimizing Chest Wall Recoil

Passive Recoil

Active Decompression

Conventional CPR

ACD-CPR

10 kg of lifting force
Active DEcompression

- Actively lift the chest until ≈10 kg force
- *Not necessary to lift with >10 kg of force.*
- Use less lift if cup dislodges before then.
Warnings from Experience

• Do not use ResQPUMP® if standing or straddling the patient (too much force potential)

• Do not use ResQPUMP® if the patient is moving (too much improper force vector potential/force potential).

• Do not use ResQPUMP® during transport to the ED (too much force potential and risk to compressor for fall/injury)

• The ResQPUMP® should not be used in patients who have had a recent (< 6 months) sternotomy.
Troubleshooting from Experience

- Rib fractures
  - Check for proper placement and continue*
    - *Caution with forces of compression/decompression

- Pneumothorax – be aware of developing tension
  - Needle decompression and caution with forces

- Redness or bruising to chest
  - Continue

- Sliding on chest
  - Likely indication of improper/not true vertical force
  - Reposition quickly and continue
Suburban Memphis Outcomes to Date

• 2014 Baseline ROSC 9/27 (33%)
• 2015 ROSC 13/28 (41%)
  – Before ResQCPR™ System 8/20 (40%)
  – With ResQCPR™ System 6/14 (43%)
• In the first 4 months of ResQCPR™
  – 6/10 (60%) ROSC
  – Hosp DC 37% (witnessed, bystander, 911)
Metro OKC/TUL Outcomes to Date

• 10/1/15 – 1/10/16
• 348 cardiac arrest resuscitations
• 172 (49%) with ResQCPR™ System
• ***Only 229/348 (66%) reviewed to date
  • 109 ResQCPR™
  • 120 S-CPR
Metro OKC/TUL ResQCPR™ v S-CPR

- ResQCPR™
- Compression/min 93
- CC Fraction 89%
- Vent/min 8
- Male 63%
- Avg Age 75
- Initial VF 15%
- Initial Asystole 54%
- Initial PEA 24%

- S-CPR
- Compression/min 103
- CC Fraction 87%
- Vent/min 8
- Male 54%
- Avg Age 83
- Initial VF 12%
- Initial Asystole 48%
- Initial PEA 30%
Metro OKC/TUL ResQCPR™ v S-CPR

<table>
<thead>
<tr>
<th></th>
<th>ResQPump</th>
<th>Manual CPR</th>
<th>All</th>
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<tbody>
<tr>
<td></td>
<td>Total</td>
<td>%</td>
<td>Total</td>
</tr>
<tr>
<td>CPC 1</td>
<td>2</td>
<td>1.83%</td>
<td>10</td>
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<tr>
<td>CPC 2</td>
<td>1</td>
<td>0.92%</td>
<td>3</td>
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<tr>
<td>CPC 3</td>
<td>4</td>
<td>3.67%</td>
<td>4</td>
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<tr>
<td>CPC 4</td>
<td>0</td>
<td>0.00%</td>
<td>1</td>
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<tr>
<td>Dead</td>
<td>102</td>
<td>93.58%</td>
<td>102</td>
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What’s it all about?

• What’s the goal of all the clinically applied physics?
It’s NOT this...
Saving the Heart AND Brain
Real Life After ROSC
ResQPR™ Summary

Evidence-based advance.
Requires careful training and use like any medical procedure.
Most effective when the whole system of CPR care is optimized.
Improves perfusion dynamics in OOH SCA.
More analysis is still needed!
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Thank you!

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