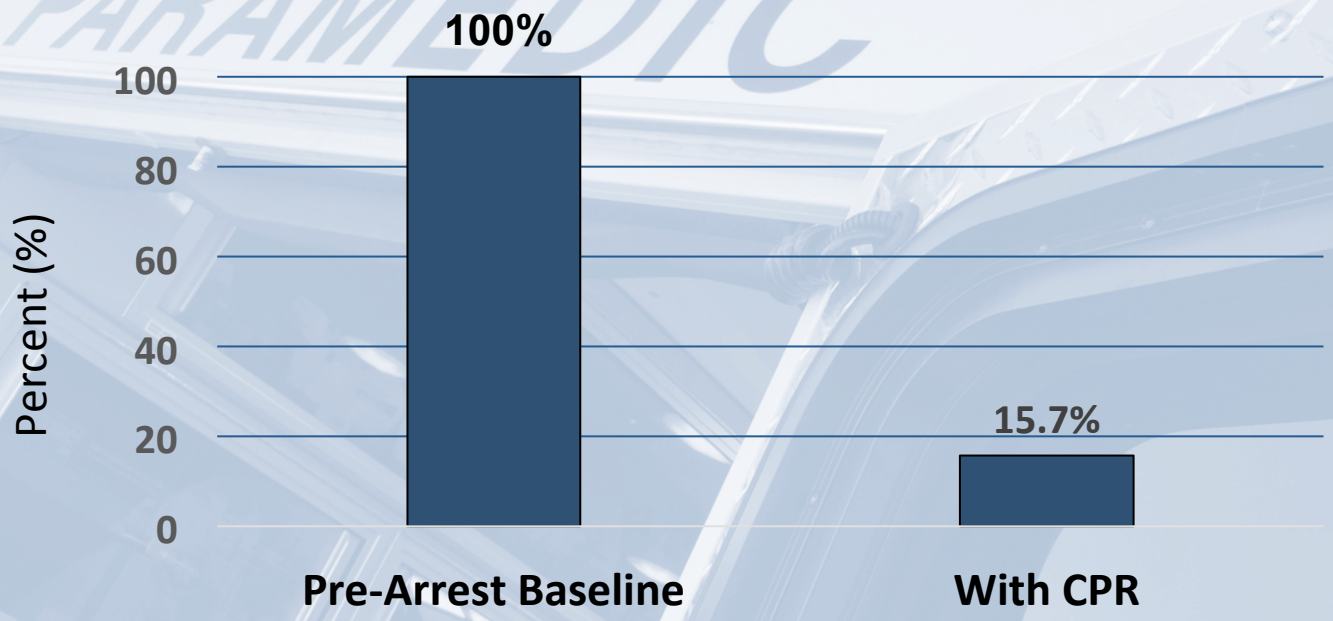
Taking the Guessing Out of Decompressing the Pressing: Post FDA Experience with ACD-ITD CPR

Jeffrey M. Goodloe, MD, NRP, FACEP
Medical Director, Medical Control Board
EMS System for Metropolitan Oklahoma City & Tulsa
Professor & EMS Section Chief, Department of Emergency Medicine
University of Oklahoma School of Community Medicine

Joe E. Holley, MD, FACEP
Medical Director, Memphis Fire Department EMS
City of Memphis & Shelby County, Tennessee
Fellow, College of MacGyver Medicine


EMERGENCY MEDICAL SERVICES
MEDICAL CONTROL BOARD
MCB
OMD
OFFICE OF THE MEDICAL DIRECTOR
METROPOLITAN OKLAHOMA CITY AND TULSA
EMERGENCY MEDICINE
UNIVERSITY OF OKLAHOMA
EMS SECTION
40
SHELBY
COUNTY
MEMPHIS
DIVISION OF
FIRE SERVICES
TENNESSEE

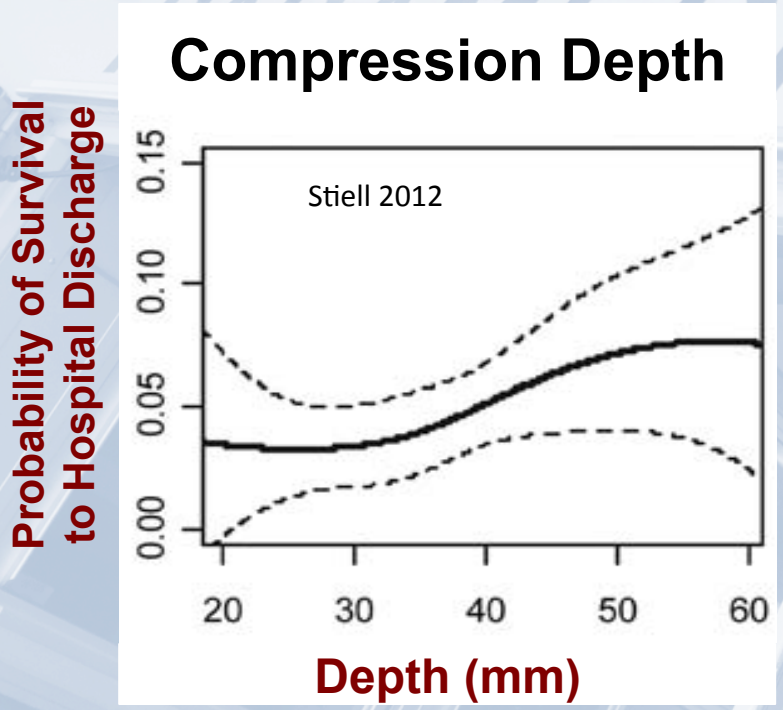
Cardiac Output During S-CPR

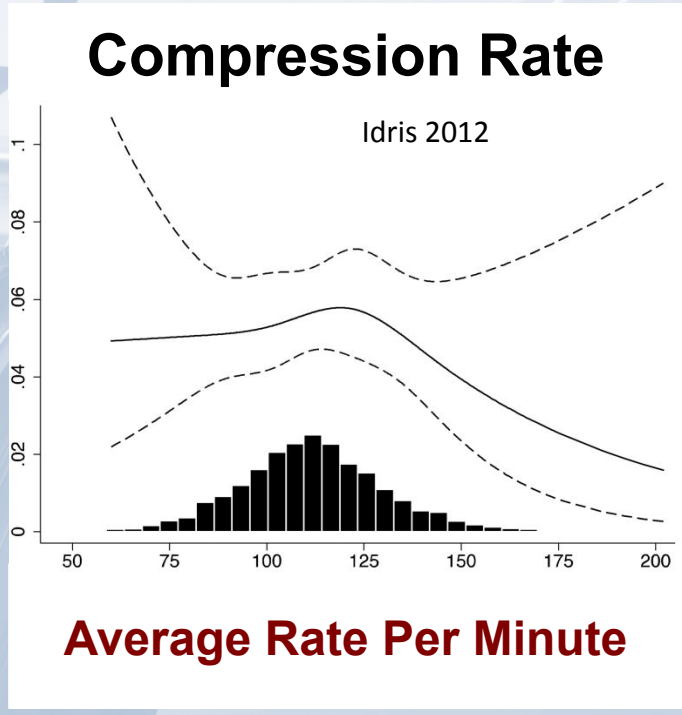


Duggal et al. J Appl Physiol 1993;74(1):147-152.

Is all S-CPR the same?

Wide variations exist even in some of the best EMS systems (ROC data)



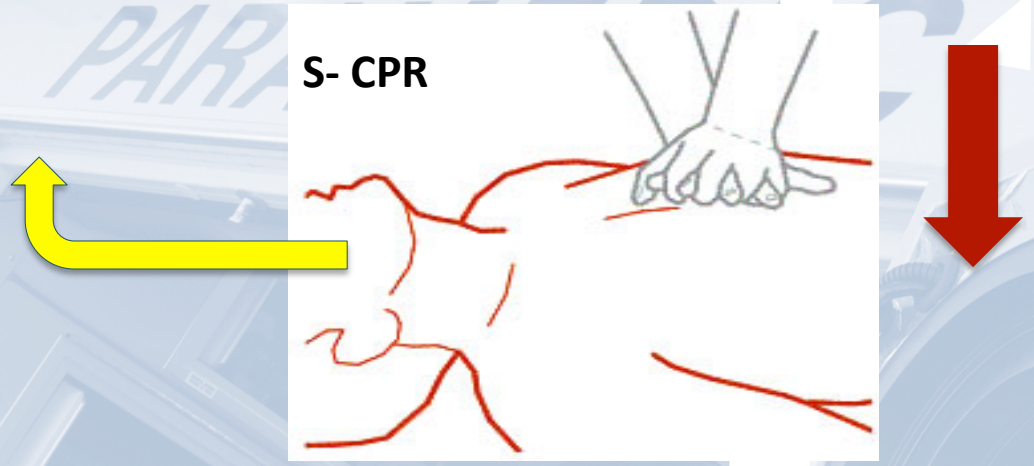


ACD CPR in Paris - 2000

ACD CPR Device - 2015

Compression Phase

Standard CPR (S-CPR) vs. ResQCPR™

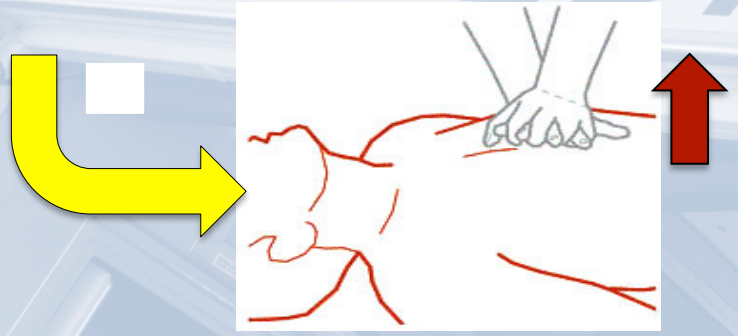


Minimal expiratory resistance w/ResQPOD®

DE-compression Phase

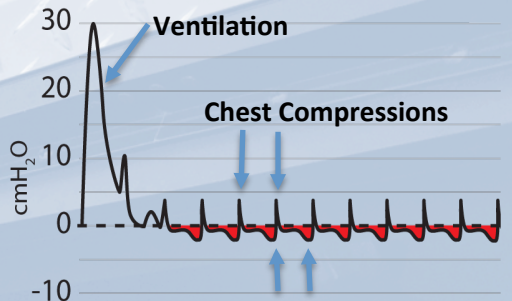
Standard CPR vs. ResQCPR™

S- CPR – Passive Recoil



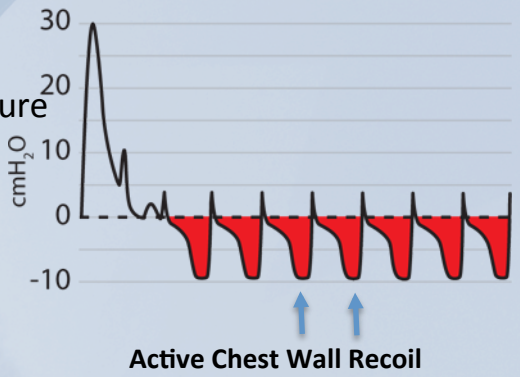
- Minimal change in intrathoracic pressure
- Small ↑circulation

Airway (Intrathoracic) Pressure



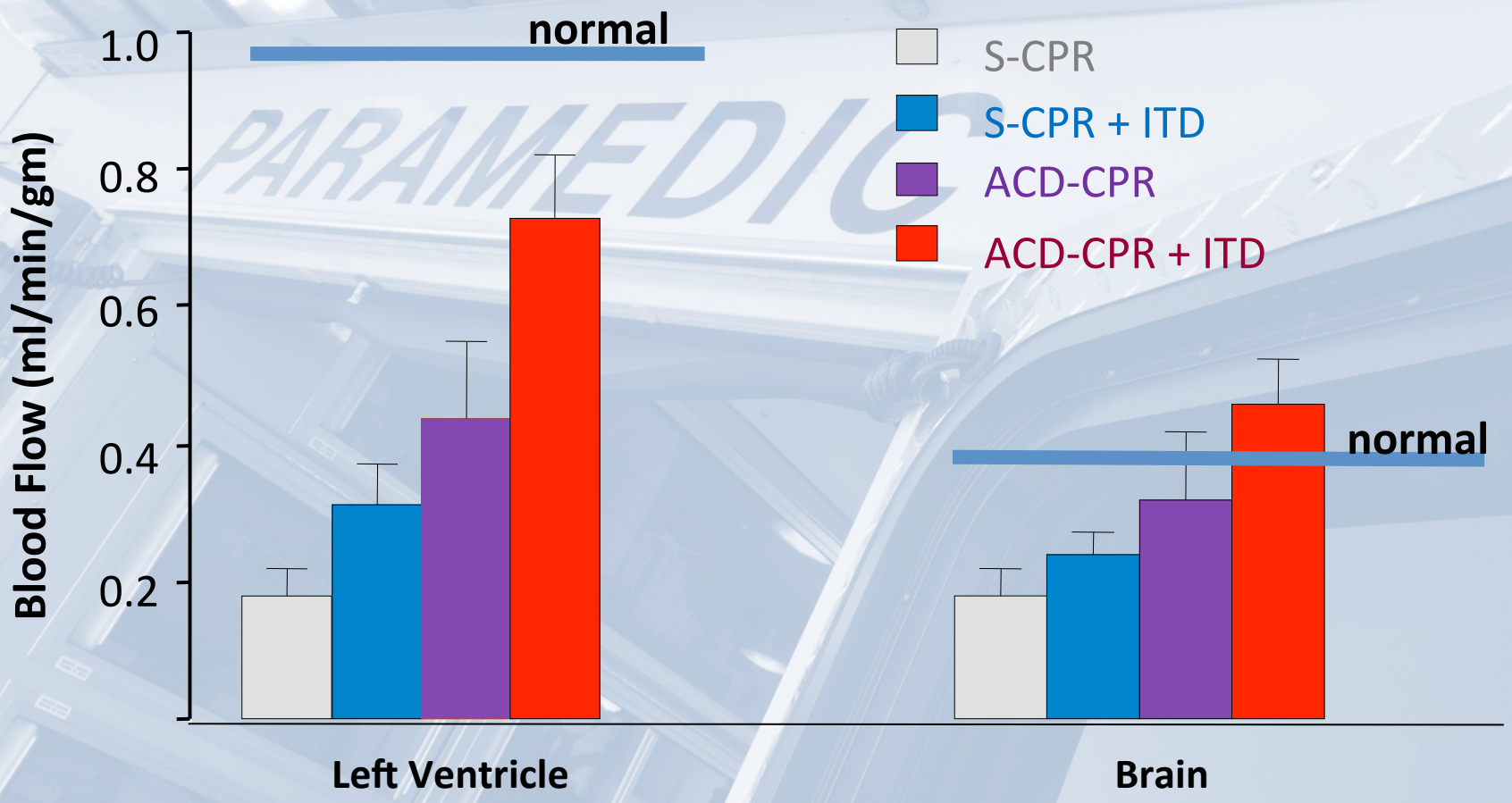
ResQCPR™ – Active Recoil

- ↓↓ intrathoracic pressure
- Preload increased → ↑↑ cardiac output
- ICP lowered → ↑↑ cerebral perfusion



Blood Flow to Heart and Brain

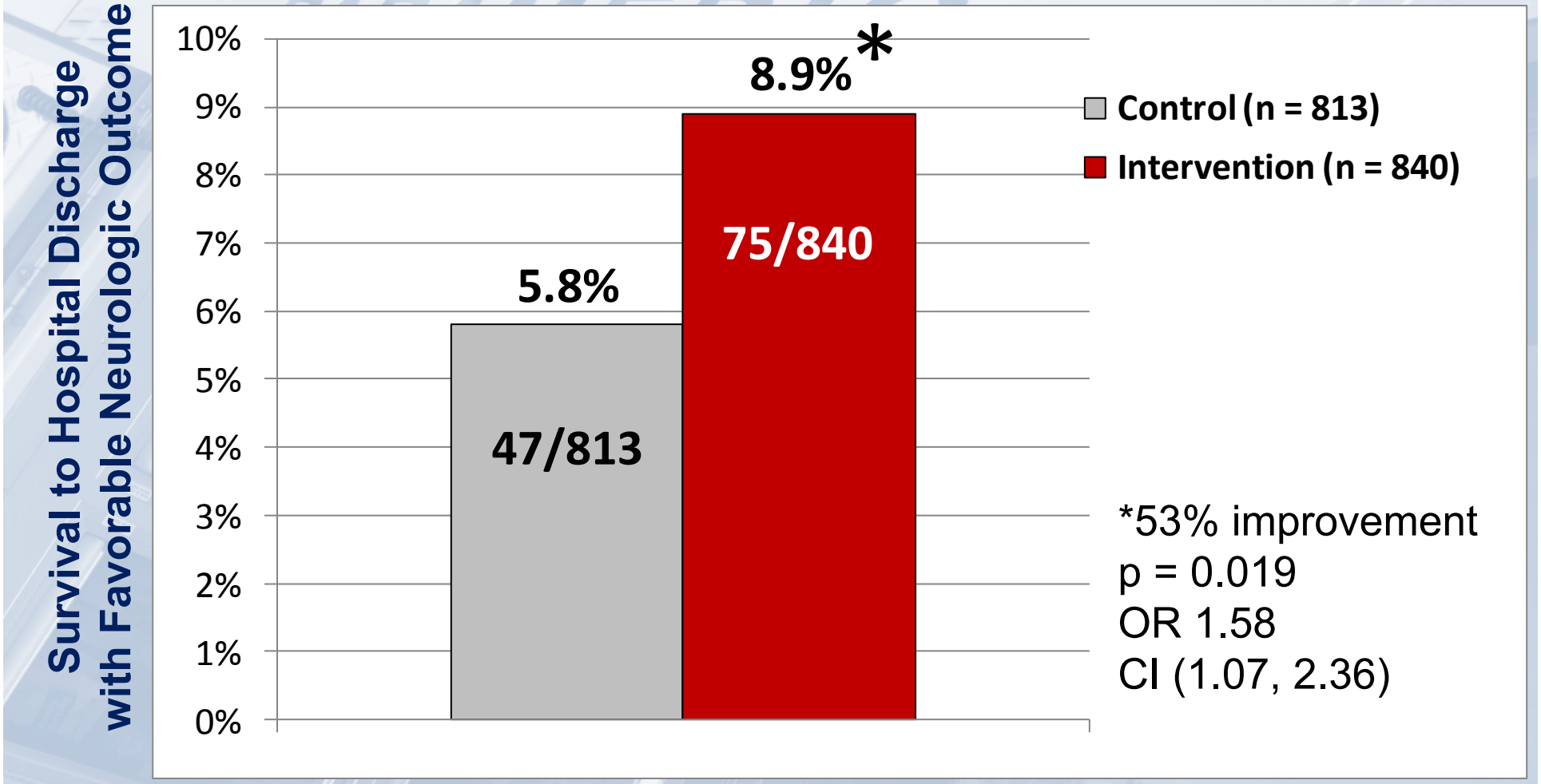
Porcine V-Fib Model



Lurie et al. Circulation 1995;91:1629-32 (ACD +/- ITD) and Lurie et al. J Cardio Electrophysiology 1997;8(5):584-600

ResQTrial (ACD+ITD CPR v S-CPR)

Aufderheide TP et al. Lancet. 2011 Jan 22;377(9762):301-11.



ResQTrial: Major Adverse Events

Adverse Event; n (%)	Control (N = 813)	Intervention (N = 840)	P-value
Pneumothorax	7 (0.9)	10 (1.2)	0.628
Internal organ injury	2 (0.2)	4 (0.5)	0.687
Pulmonary edema	62 (7.6)	94 (11.2)	0.015
Chest fracture(s)	15 (1.8)	12 (1.4)	0.563
Aspiration	7 (0.9)	8 (1.0)	1.000

A funny thing happened on the way through the FDA…

Finally!
Implementing ResQCPR™

Implementing ResQCPR™

Training and retraining

the physiology is not intuitive

*"*One and done" is not enough in CE

Tracking outcomes

ROSC, neurological awakening, complications

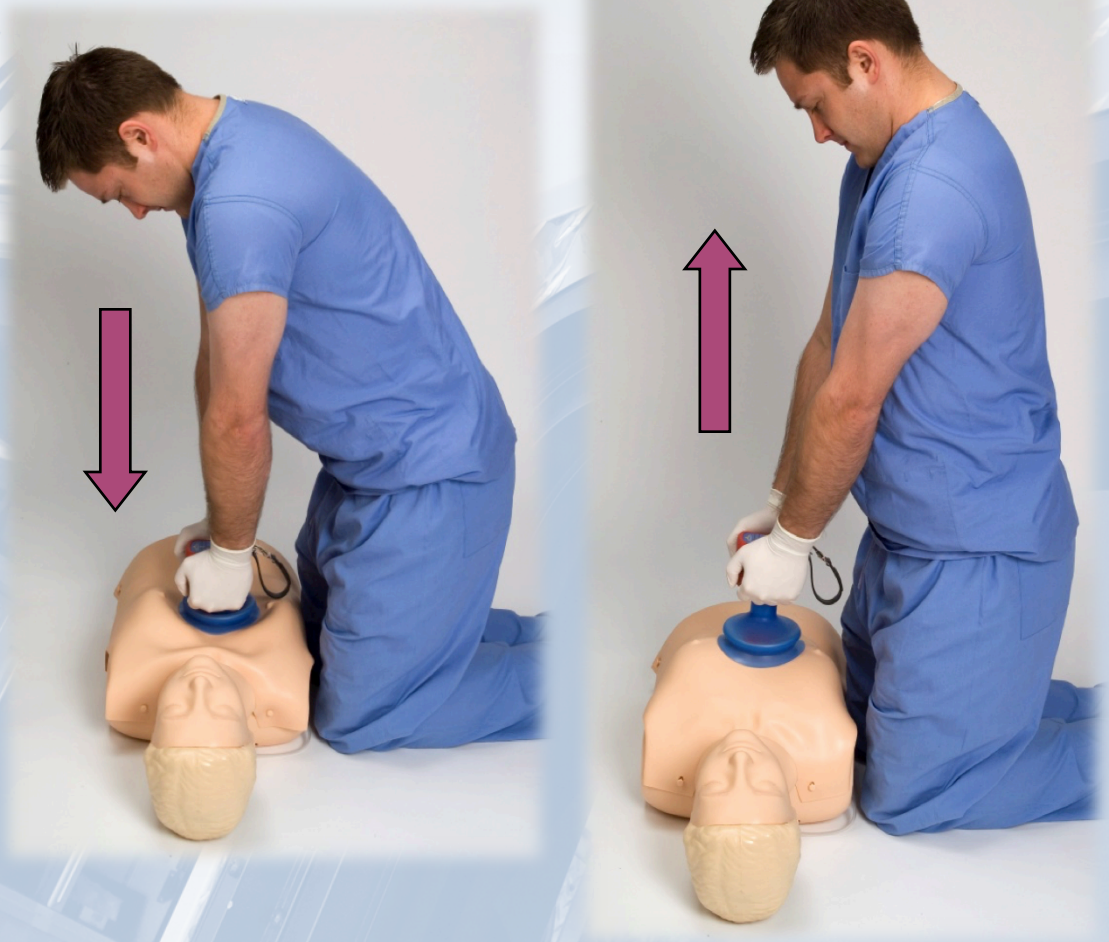
What should be expected?

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…

Compress & Lift

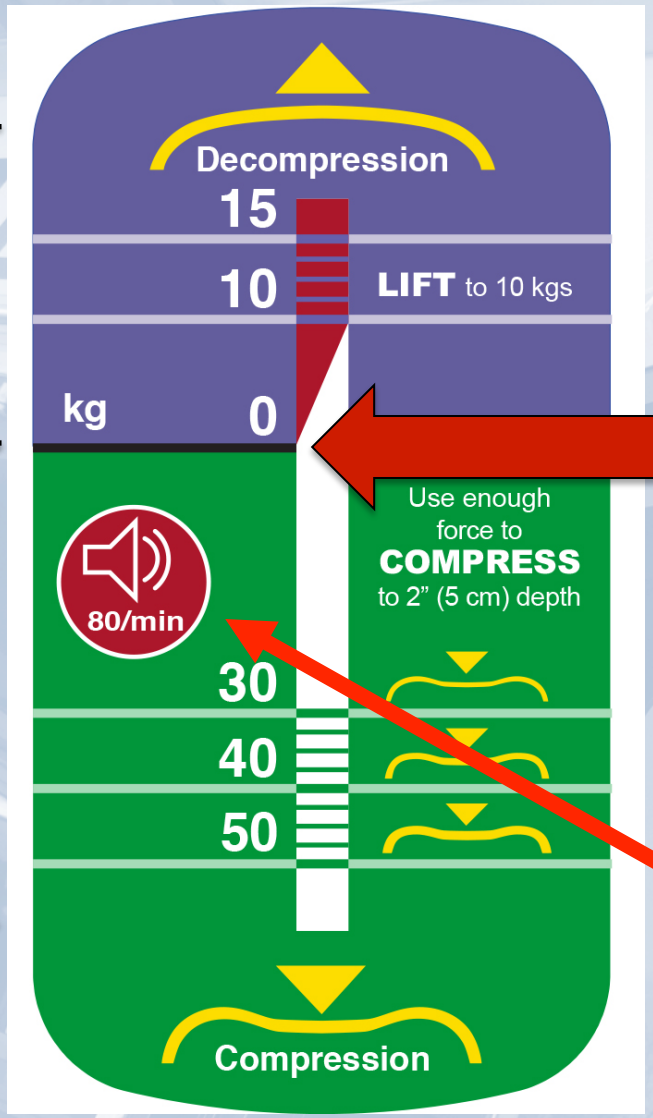
- Bend at waist
- Use upper body and thighs to compress and lift.
- 50% compress
- 50% decompress



Force Gauge & Metronome

Purple area guides LIFTING forces

Green area guides COMPRESSION forces

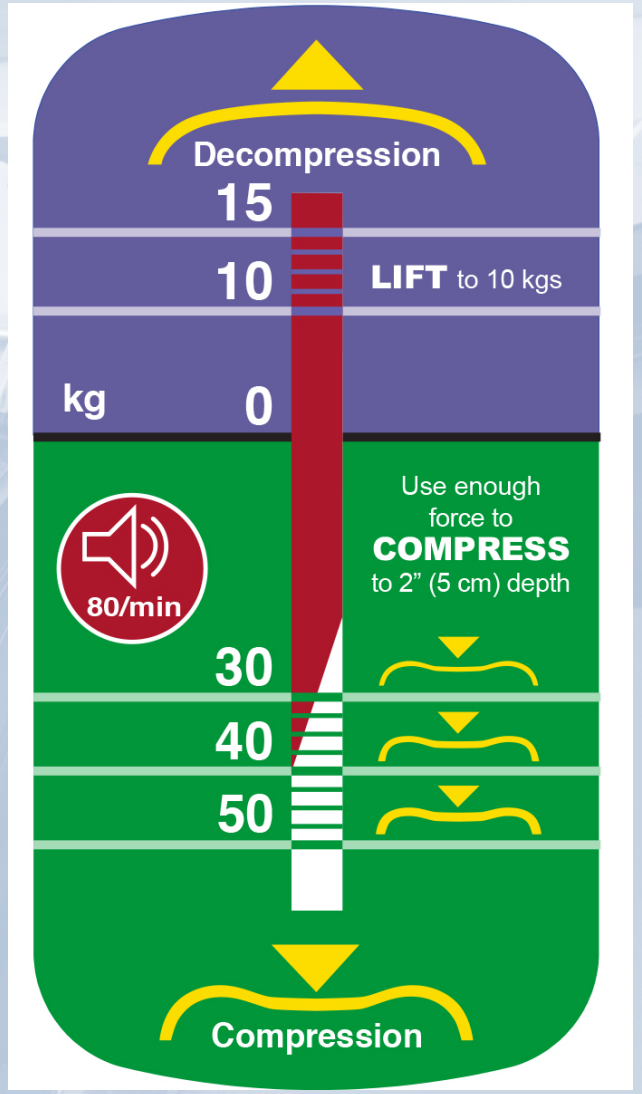


Bottom of red arrow at ZERO indicates no lift or compression being applied

80 NOT a natural rate for EMS

Active Compression

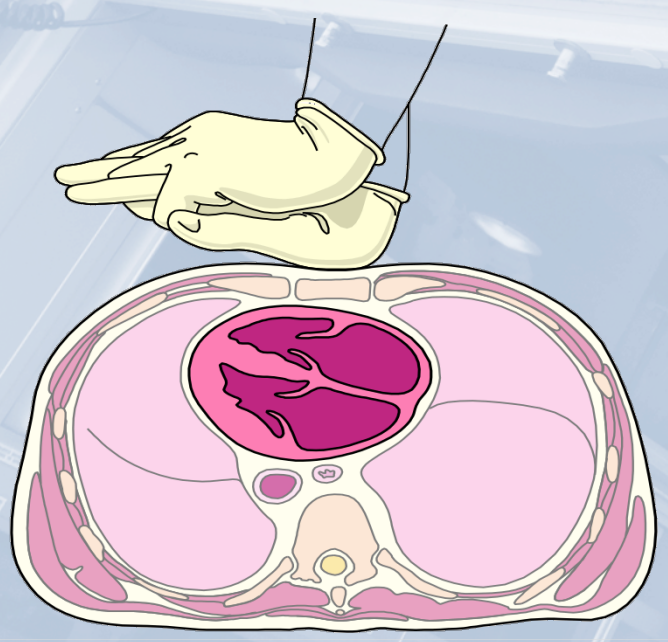
- **Similar depth as conventional CPR**
  - **2 inches** (or ~5 cm)
- *Note amount of force needed to compress to 2 inches*
- Use bottom of red arrow
- Approximate amounts of force needed:
  - Soft chest: ≈30 kg
  - Average chest: ≈40 kg
  - Stiff chest: ≈50 kg
- ≤ 40 kgs should be sufficient for most

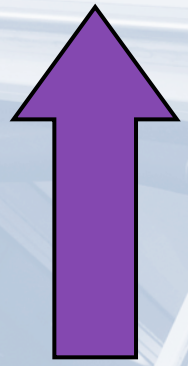


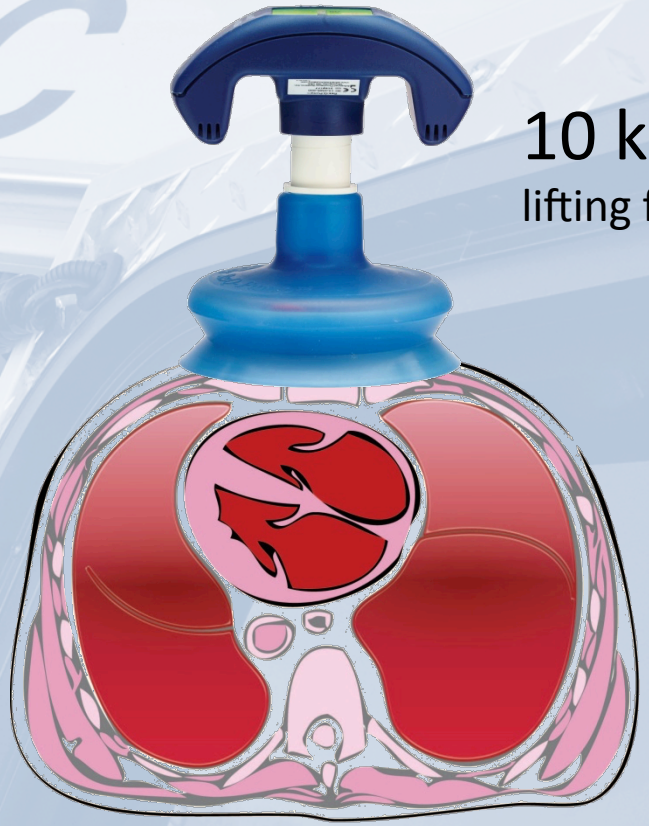
Optimizing Chest Wall Recoil

Passive Recoil

Active Decompression







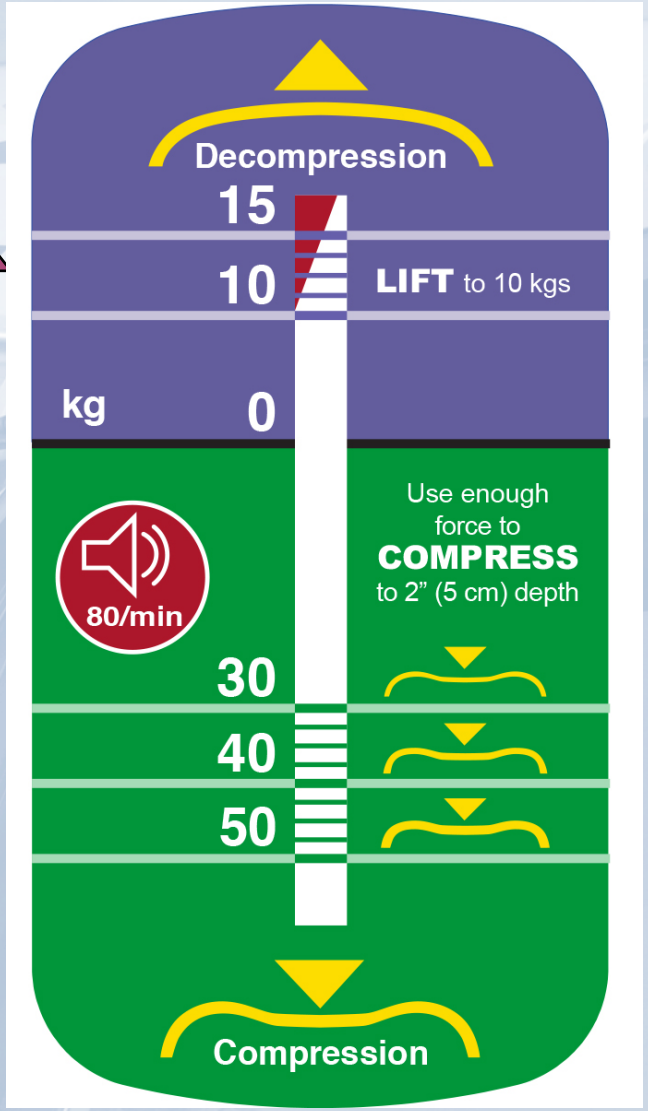
10 kg of lifting force

Conventional CPR

ACD-CPR

Active DEcompression

- Actively lift the chest until ≈10 kg force
- ***Not necessary to lift with >10 kg of force.***
- <u>Use less lift if cup dislodges</u> 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

	ResQPump		Manual CPR		All	
	Total	%	Total	%	Total	%
CPC 1	2	1.83%	10	8%	12	5%
CPC 2	1	0.92%	3	3%	4	2%
CPC 3	4	3.67%	4	3%	8	3%
CPC 4	0	0.00%	1	1%	1	0%
Dead	102	93.58%	102	85%	204	89%

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

ResQCPR™ Summary

Evidence-based advance.

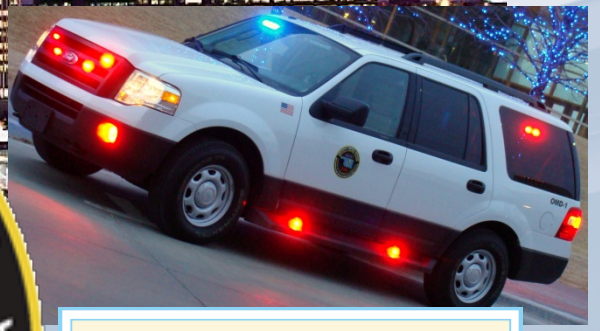
Requires careful training and use like any medical procedure.

Most effective when the whole system of CPR care is optimized.

Improves perfusion dynamics in OOH SCA.

More analysis is still needed!

TULSA FIRE DEPARTMENT
PROTECTING LIFE, HEALTH, PROPERTY & ENVIRONMENT
EST. 1900



EMERGENCY MEDICAL SERVICES
MEDICAL CONTROL BOARD
MCB
OMD
OFFICE OF THE MEDICAL DIRECTOR
METROPOLITAN OKLAHOMA CITY AND TULSA

FIRE RESCUE EMS
OKC
EST 1889

OU EMERGENCY MEDICINE
UNIVERSITY OF OKLAHOMA
EMS SECTION

Contact Info:
jeffrey-goodloe@ouhsc.edu
Office of the Medical Director
405-297-7173

Thank you!

Contact Info

joe.holley@memphistn.gov