

The Emerging Role of ITP Modulation in Resuscitation

R.J. Frascone, M.D. FACEP
Professor, Department of Emergency Medicine
University of Minnesota
Medical Director
Regions Hospital EMS

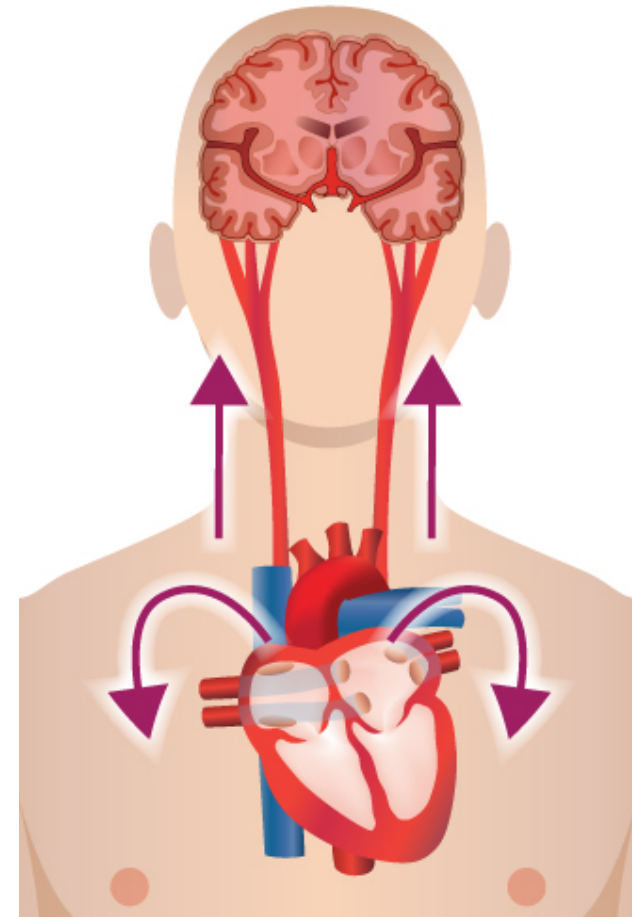
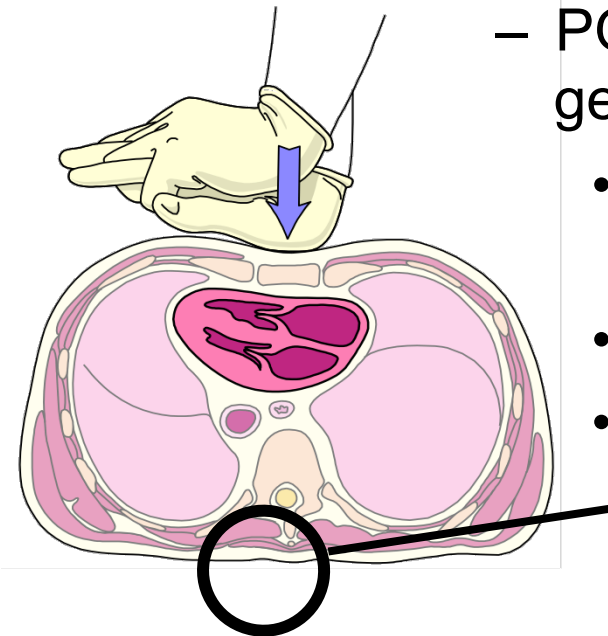
Disclosures

- Investigator for ResQ Trial
- Part of a group of independent investigators who have published a paper analyzing data from ROC PRIMED Study
- I have not financial connections to ACSI/Zoll or Physio Control

R.J. Frascone MD, FACEP
Handling the Pressure and Going with the Flow:
Using ITP Modulation to Save Lives

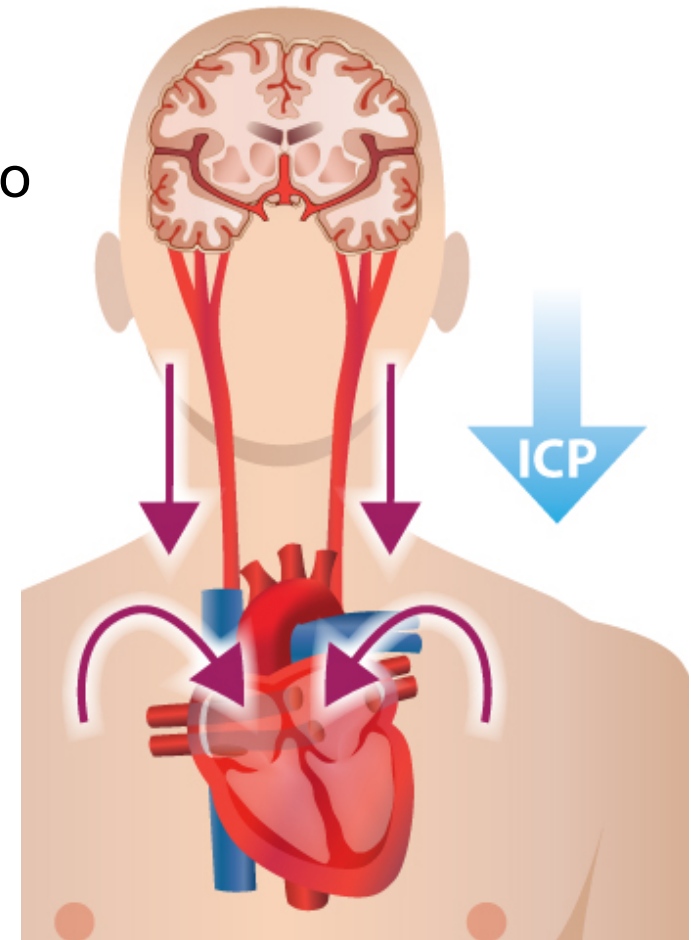
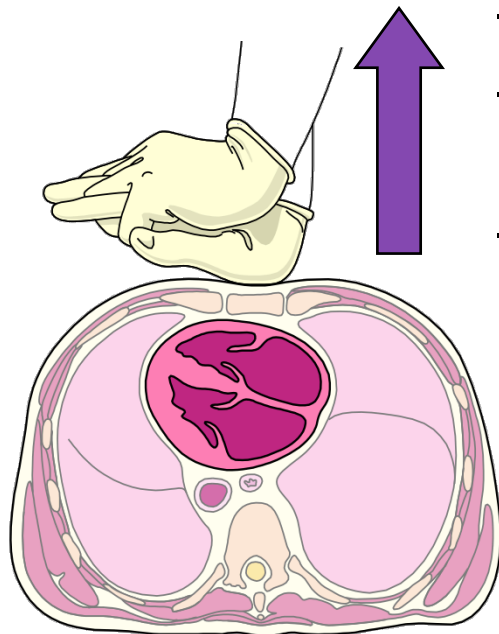
The Two Theories of How CPR Works

- **CARDIAC PUMP Theory**
 - Heart squeezed between sternum and spine
- **THORACIC PUMP Theory**
 - POSITIVE PRESSURE generated causes:
 - Blood to be expelled (CARDIAC OUTPUT)
 - Air to exit the lungs
 - Intracranial pressure (ICP) to rise
 - Pressurizes venous syst
 - Paravertebral sinuses connect head to chest

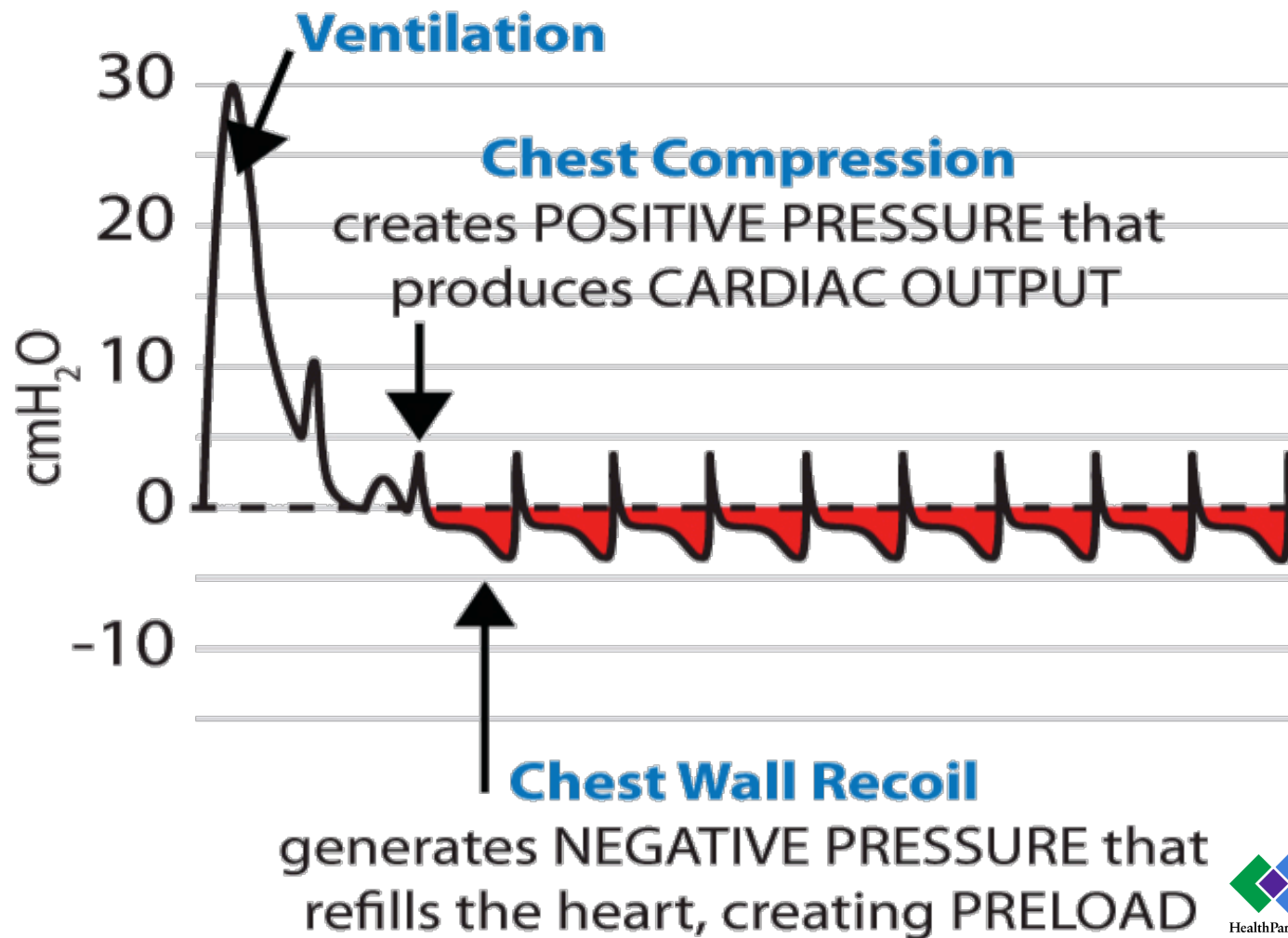


Decompression Phase

- **NEGATIVE PRESSURE (vacuum) develops**
 - Blood is drawn back into heart (PRELOAD)
 - Air is drawn into lungs
 - Coronary blood flow occurs
 - ICP is lowered
 - Increased venous drainage
 - Increased CSF drainage



Airway Pressures During CPR



Conventional CPR is Suboptimal



- Even when performed correctly, it provides only:
 - **20 – 30%** of normal blood flow to the **BRAIN**
 - **10 – 20%** of normal blood flow to the **HEART**

S-CPR vs. ACD CPR

- Standard CPR is completely reliant on chest recoil to achieve preload.
- The chest wall may not recoil for several reasons
 - The chest wall “softens” with CPR (increased compliance).
 - Chest wall may be too stiff to recoil properly
 - Just doing it wrong
- ACD does not rely on recoil. It will pull the chest wall back whether it wants to come back, or not.
- In addition, manual active decompression hyper expands the chest (goes beyond neutral).

ACD CPR device



ACD CPR: Compression

- Actively compressing the chest, increasing IP pressure and thereby forcing blood out of chest, just like s-CPR.
- Same position as standard CPR
- 40 – 50 cm (1 ½ - 2")
 - Soft chest: 65 lbs
 - Average chest: 90 lbs
 - Stiff chest: 110 lbs



ACD CPR: Decompression

But, unlike S-CPR it actively decompresses the chest, decreasing IP pressure, thereby drawing blood into the chest.

- Typically 15-20 lbs



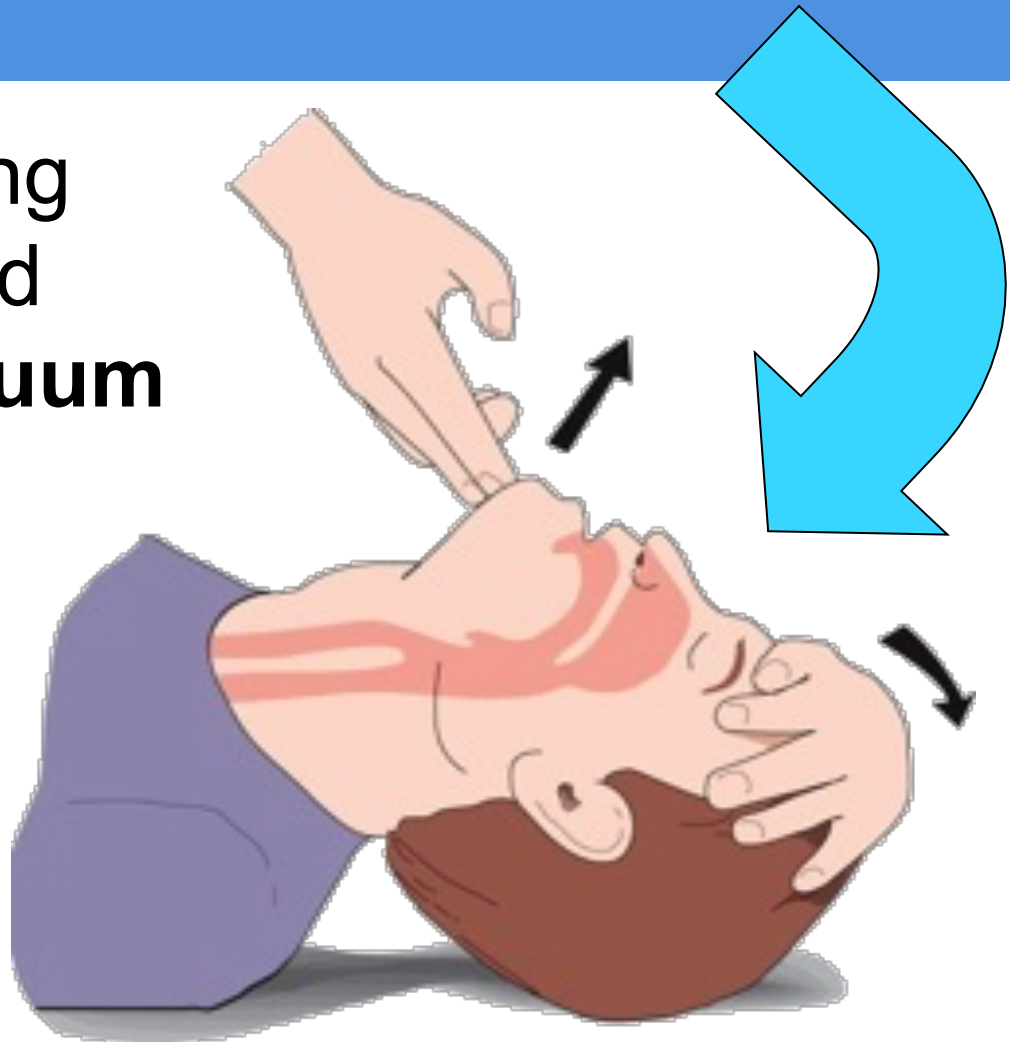
Caution: LUCAS is not ACD



Inefficiency of CPR

Air is drawn in during chest wall recoil and **wipes out the vacuum** to re-fill the heart.

Heart stops filling as soon as the vacuum is neutralized.

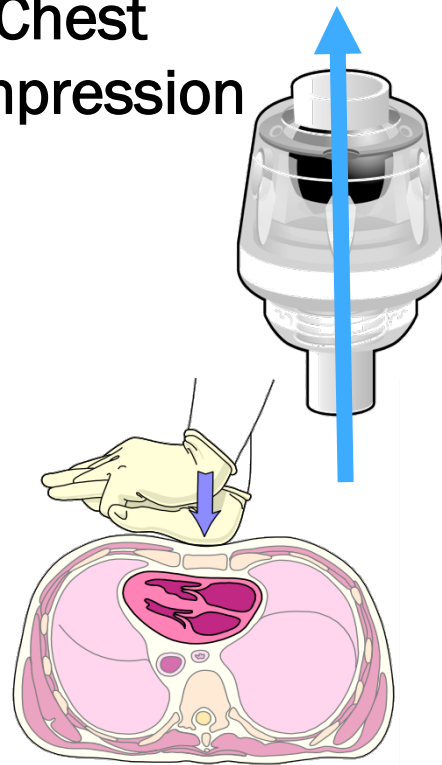


ITD



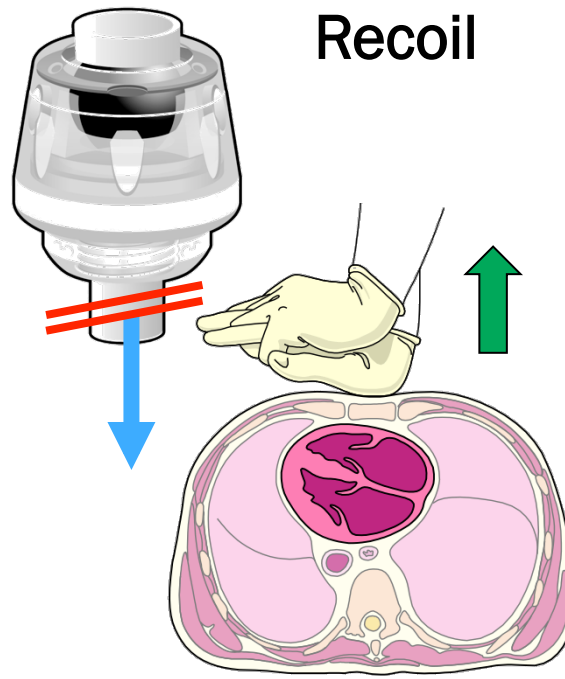
Airflow Through an ITD

**Chest
Compression**



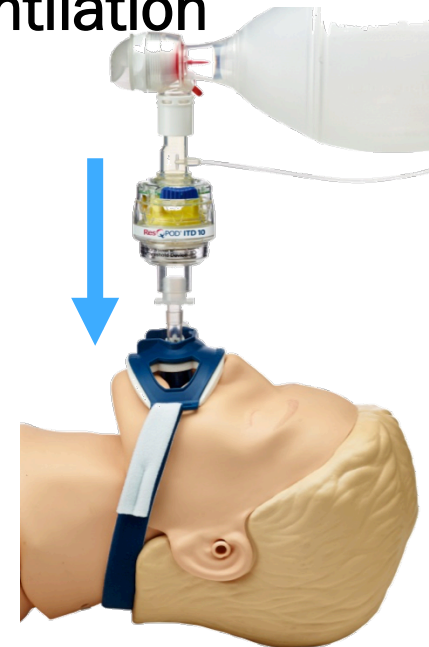
Patient can freely
exhale.

**Chest Wall
Recoil**



Influx of air is prevented,
enhancing the vacuum in
the chest.

**Patient
Ventilation**



Patient can be
freely ventilated.

ResQTRIAL: 2005 - 2009

Standard CPR (S-CPR)

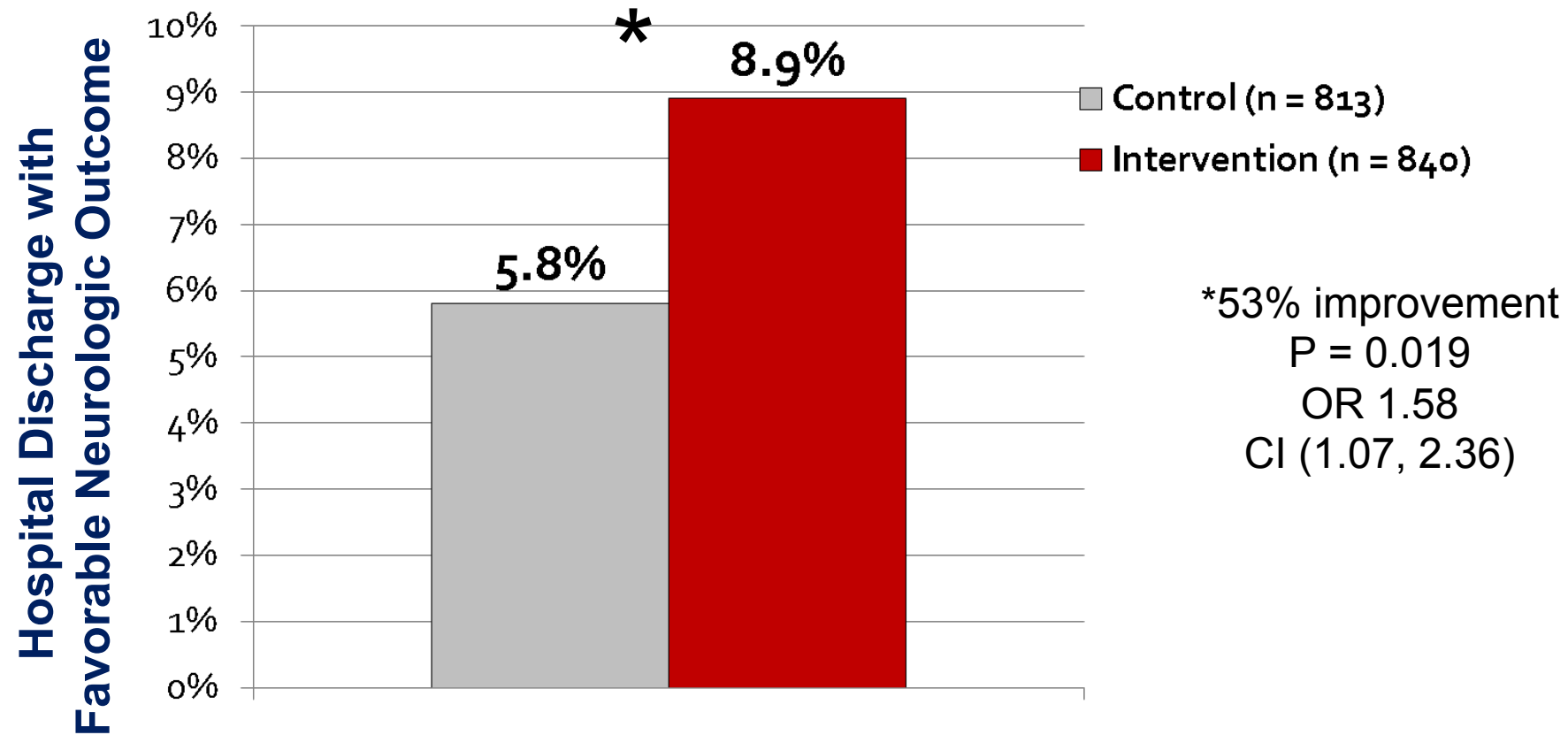


versus

ACD-CPR + ITD (ACD+ITD)



Primary Study Endpoint



THE LANCET

Volume 377 • Number 9762 • Pages 271-352 • January 22-28, 2011

www.thelancet.com

"Cardiopulmonary resuscitation with augmentation of negative intrathoracic pressure should be considered as an alternative to standard CPR to increase long-term survival after cardiac arrest."

See Articles page 301

Comment

Cutting of access to journals in poor countries
See page 273

Perspectives

Profile: Rethy Chhem
See page 291

Articles

ACCELERATE: Combination of aliskiren and amlodipine for initial treatment of hypertension
See page 312

Articles

TEAM: Adjuvant tamoxifen and exemestane in early breast cancer
See page 321

Series

India: Towards Universal Health Coverage 2: Reproductive health, and child health and nutrition
See page 332

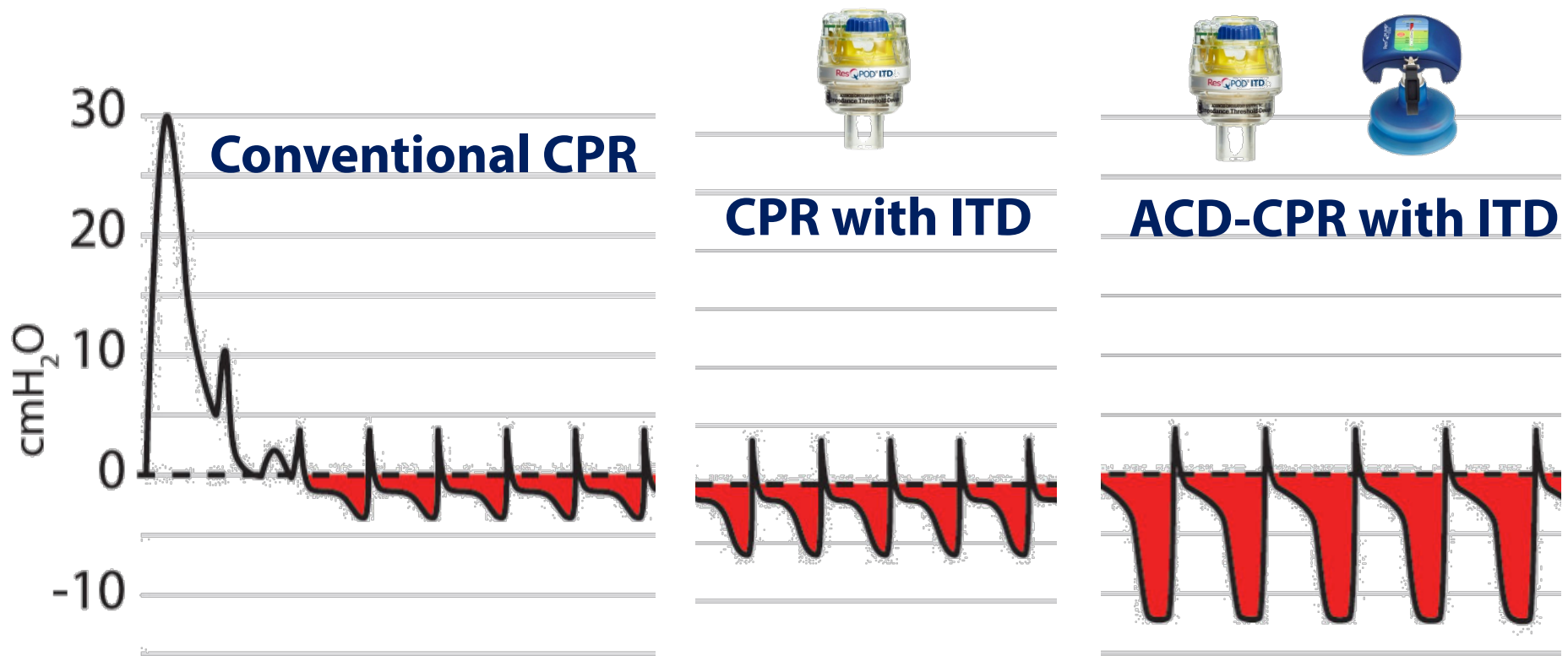
£5.00 Registered as a newspaper • ISSN 0140-6736
Founded 1823 • Published weekly



Regions Hospital

HealthPartners®

Airway Pressures During CPR



Research Summary

	ITD with S-CPR	ITD with ACD-CPR
	14 Animal studies	25 Animal studies
	13 Human studies	5 Human studies
Systolic BP	Doubled	Near -normal
Blood flow to heart	Doubled	Quadrupled
Blood flow to brain	↑ 50%	Near -normal
ICP during recoil	Lowered	Lowered further
Functional survival at hospital discharge	↑ 25% or more	↑ 53%

ORIGINAL ARTICLE

A Trial of an Impedance Threshold Device in Out-of-Hospital Cardiac Arrest

Tom P. Aufderheide, M.D., Graham Nichol, M.D., Thomas D. Rea, M.D.,
Siobhan P. Brown, Ph.D., Brian G. Leroux, Ph.D., Paul E. Pepe, M.D.,
Peter J. Kudenchuk, M.D., Jim Christenson, M.D., Mohamud R. Daya, M.D.,
Paul Dorian, M.D., Clifton W. Callaway, M.D., Ph.D., Ahamed H. Idris, M.D.,
Douglas Andrusiek, M.Sc., Shannon W. Stephens, E.M.T.-P.,
David Hostler, Ph.D., Daniel P. Davis, M.D., James V. Dunford, M.D.,
Ronald G. Pirrallo, M.D., M.H.S.A., Ian G. Stiell, M.D.,
Catherine M. Clement, R.N., Alan Craig, M.S., Lois Van Ottingham, B.S.N.,
Terri A. Schmidt, M.D., Henry E. Wang, M.D., Myron L. Weisfeldt, M.D.,
Joseph P. Ornato, M.D., and George Sopko, M.D., M.P.H.,
for the Resuscitation Outcomes Consortium (ROC) Investigators

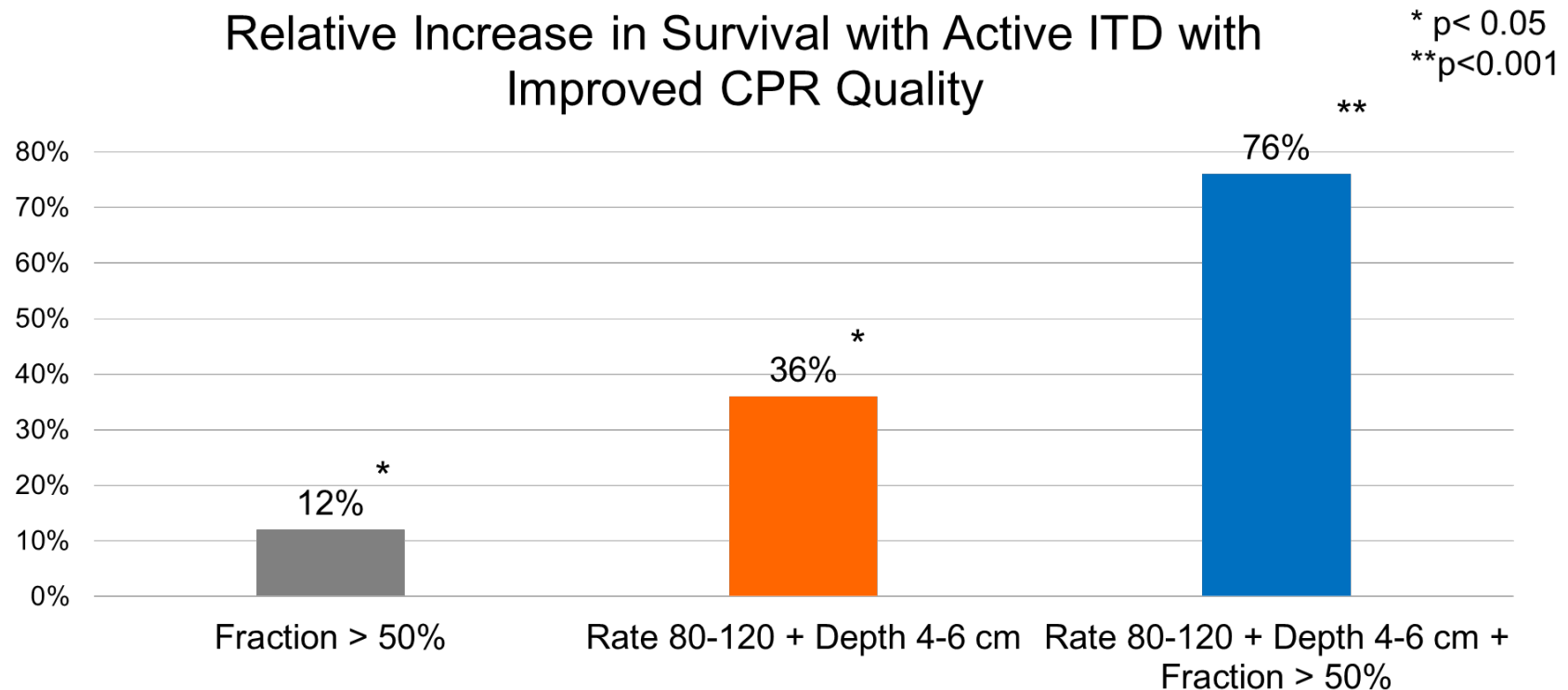
Conclusions: Use of the ITD **did not** significantly improve survival with satisfactory function among patients with out-of-hospital cardiac arrest receiving standard CPR.

The ROC investigators and others asked why did the ITD not perform?

- CPR rates varied greatly in the study population.
- The data was subsetted and when the CPR rates were done correctly a whole different picture emerged.
- Idris et al - November 2011 at AHA ReSS
- Idris et al - November 2012 at AHA ReSS
- Idris et al – January 2013 at NAEMSP

New ROC Analysis: CPR Quality Impacted ITD's Effectiveness

(not considered in 2015 AHA Guidelines)



Yannopoulos, Aufderheide, Abella, Frascone, Gooldloe, Mahoney, Nadkarni, Halperin, O'Connor, Idris, Becker, Pepe. The Effect of CPR Quality: A Potential Confounder of CPR Clinical Trials. *Resuscitation* 94 (2015) 106–113.

The “Gems” Inside the ROC...



- CPR quality matters
 - Training must focus on achieving high quality CPR
- **Sweet spot** for chest compressions likely varies depending on whether an ITD was used:
 - 100 – 120/min for conventional CPR
 - 90 – 110/min with an ITD

ACD/ITD Device Approved!

FDA: “This device is indicated for use as a CPR adjunct to improve the likelihood of survival in adult patients with non-traumatic cardiac arrest.”



Questions? Thank you!

- **R. J. Frascone, MD, FACEP**
 - Email: ralph.j.frascone@healthpartners.com