FDSC INTERNATIONAL

APRIL 15–20, 2024
Indianapolis, Indiana

ANDREW BOWMAN

BOONE COUNTY EMERGENCY MEDICINE

REFRACTORY VENTRICULAR FIBRILLATION: OLD AND NOVEL THERAPIES

Refractory VF:

Beyond ACLS: Old & Novel Therapies for Successful Management

Andrew J. Bowman
MSN, RN, ACNP-BC, ACNPC, etc., etc,.
CVRN-I-BC, NRP,
FACCN, FAEN

Refractory Ventricular Fibrillation

ACLS

Defib Vector Change and DSD

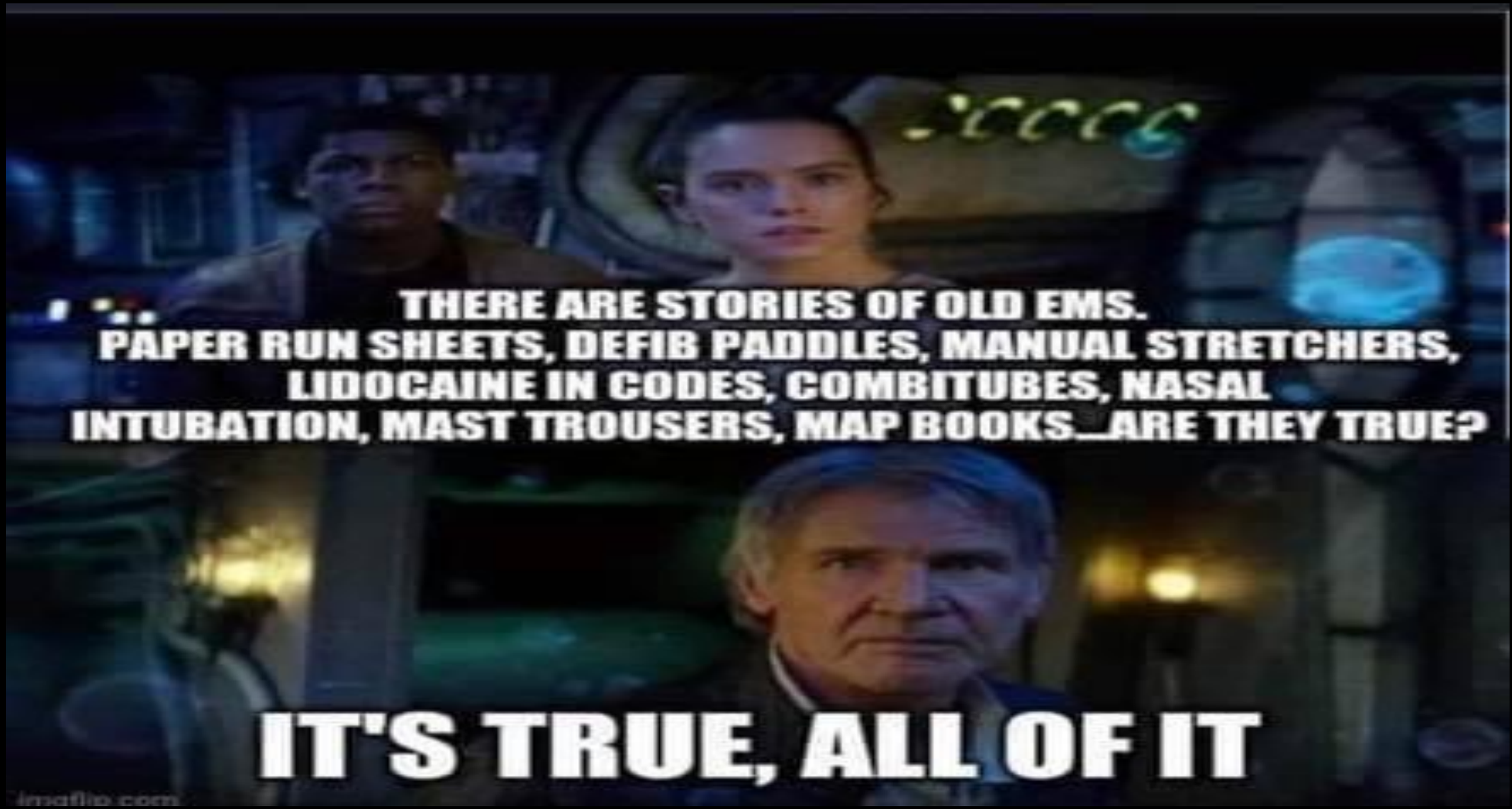
Pharmacology Old & New

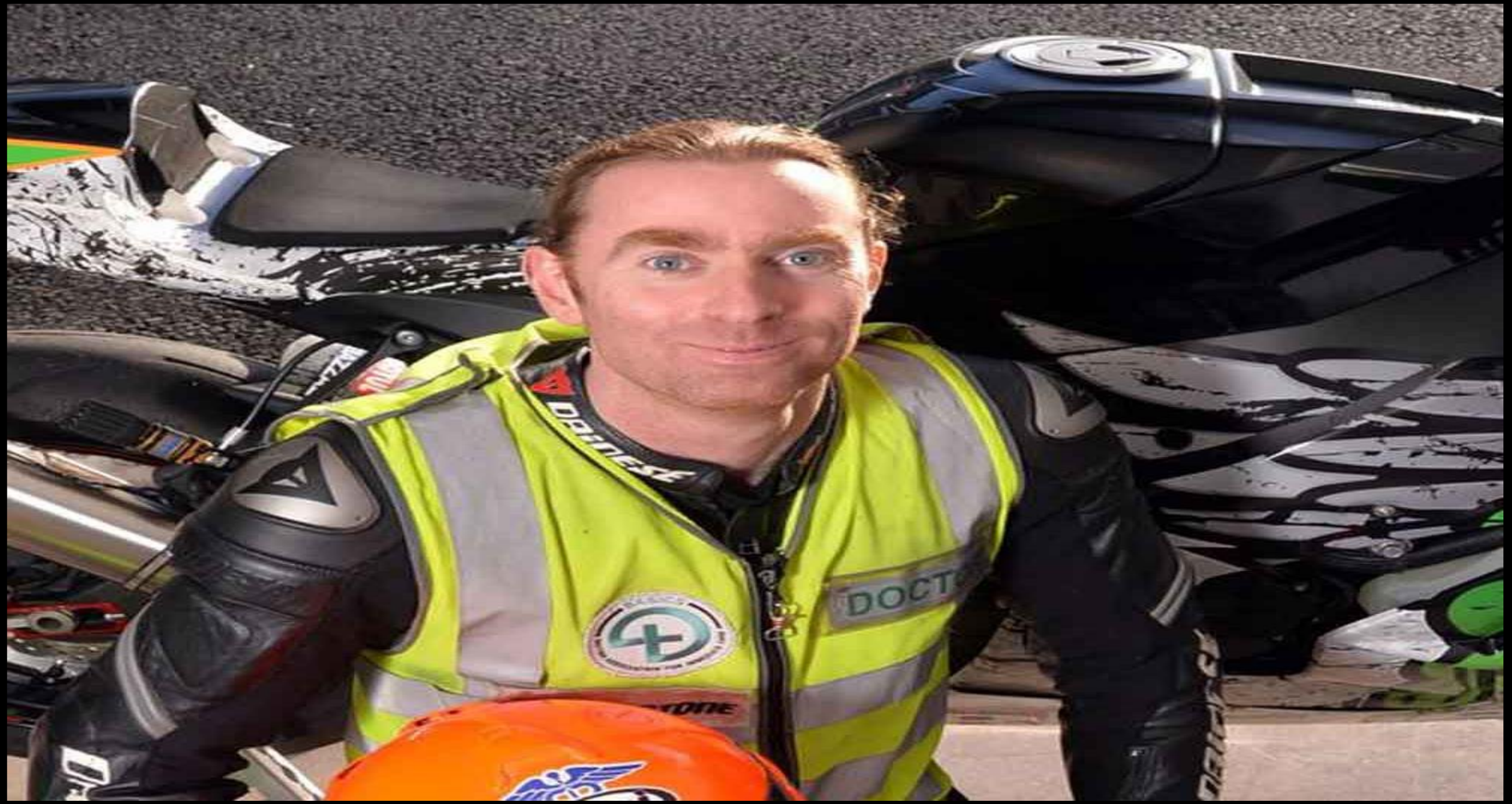
Stellate Ganglion Block

ECMO

Case Study

EMT – 1982
Paramedic - 1984
ED RN - 1991
ED NP – 2007
FACCN - 2006
FAEN - 2016
Indiana State EMS Commissioner 2016-Present
National ENA EMS Advisory Council Past Chair
National ENA Representative NEMSQA
Indiana State Representative AAENP
NAEMSP Indiana Chapter Secretary
NAEMSP EMS APP Task Force & Airway Task Force
Author – Chapters on Cardiac Arrest ED/ED NP Textbooks


THERE ARE STORIES OF OLD EMS.
PAPER RUN SHEETS, DEFIB PADDLES, MANUAL STRETCHERS,
LIDOCAINE IN CODES, COMBITUBES, NASAL
INTUBATION, MAST TROUSERS, MAP BOOKS...ARE THEY TRUE?
IT'S TRUE, ALL OF IT
imgflip.com


DAINESE
DOCT


smacc
CHICAGO

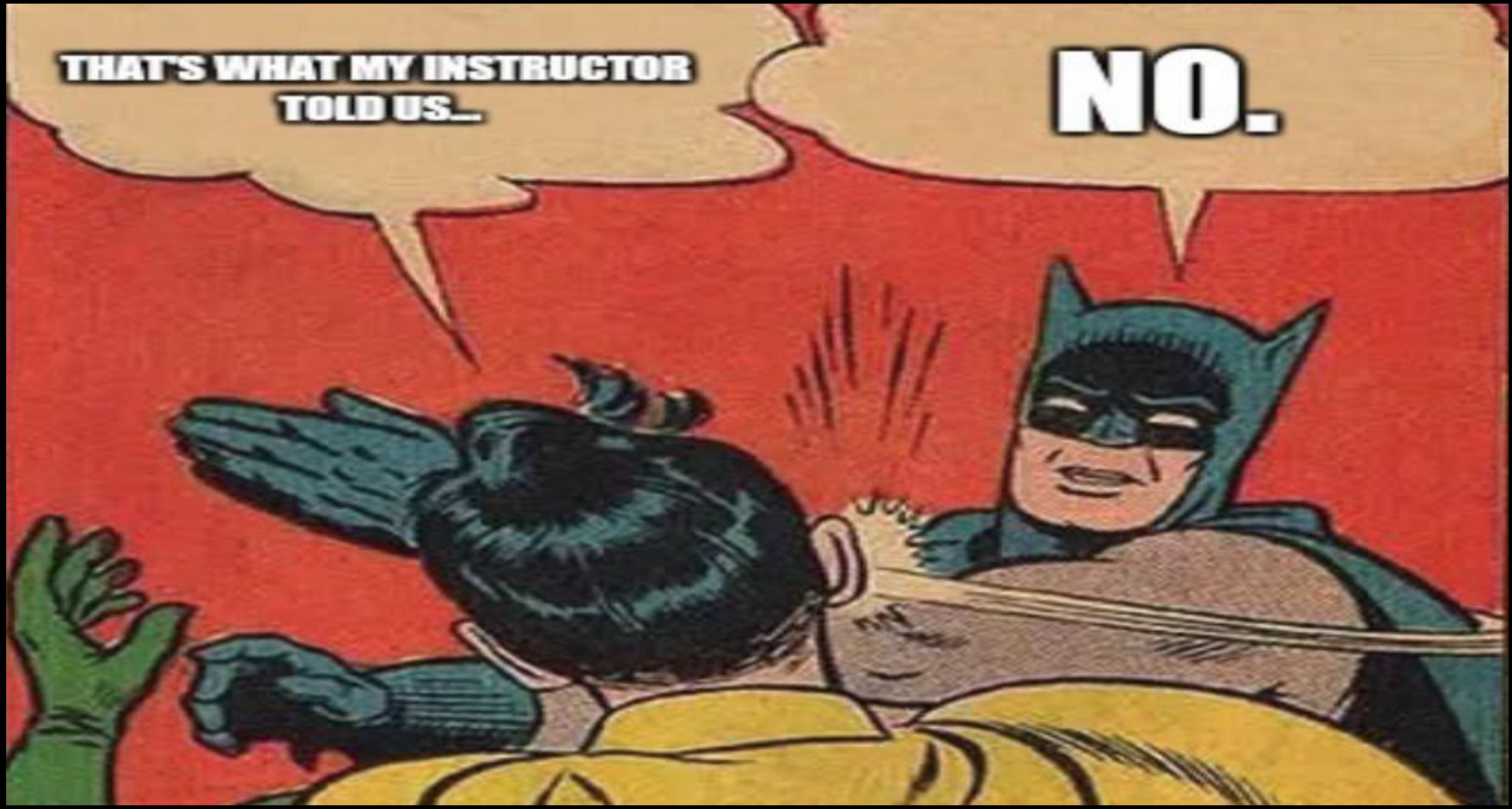

Hinds
HAAAAAAA
Crack the Chest;
Get Crucified.

deltaseven

John Hinds

1980 - 2015

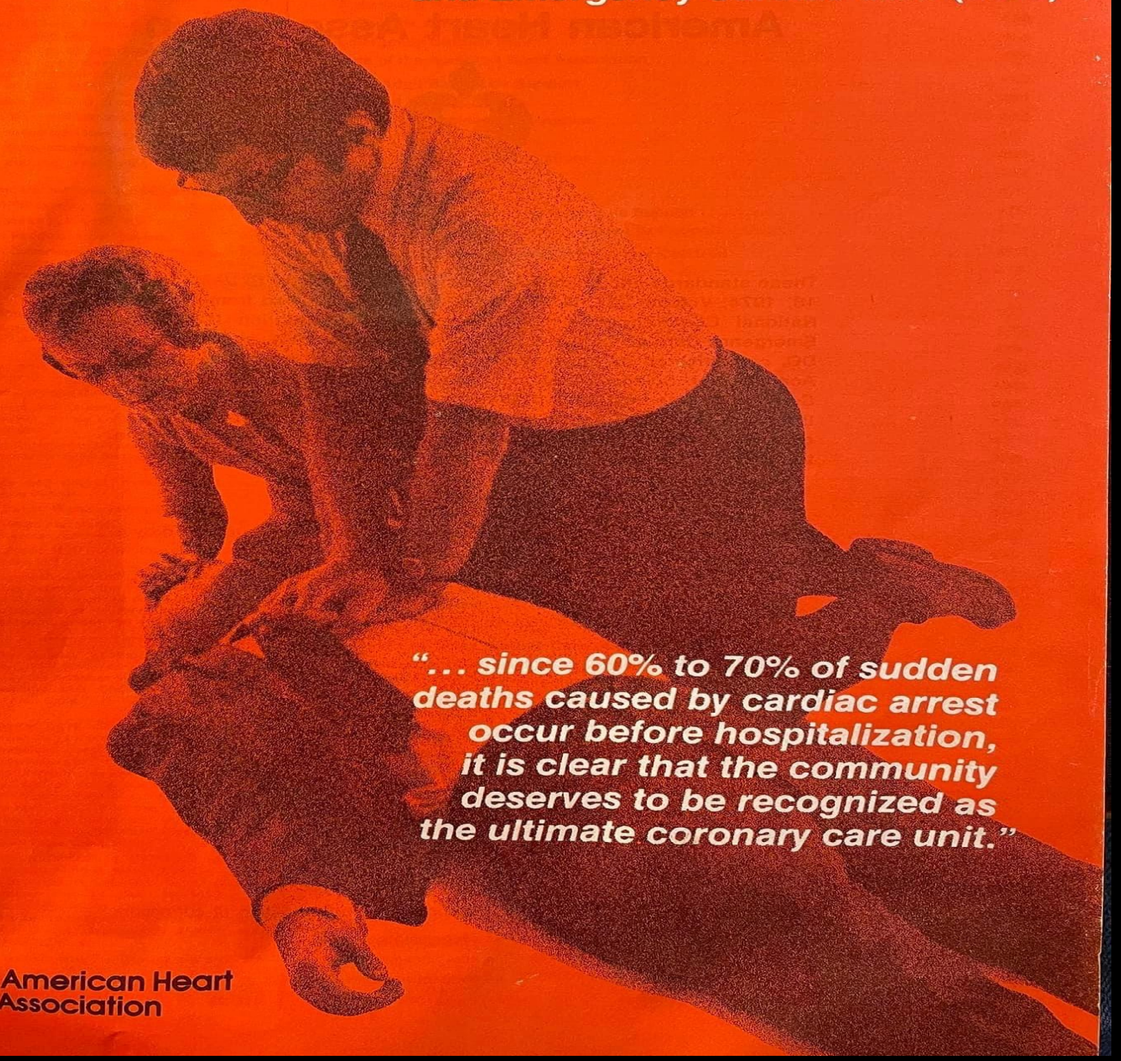
Are your intentions honorable?


THAT'S WHAT MY INSTRUCTOR TOLD US...
NO.

JAMA
THE JOURNAL of the American Medical Association

Reprinted from *The Journal of the American Medical Association*,
August 1, 1980, Volume 244, Number 5, Pages 453-509.

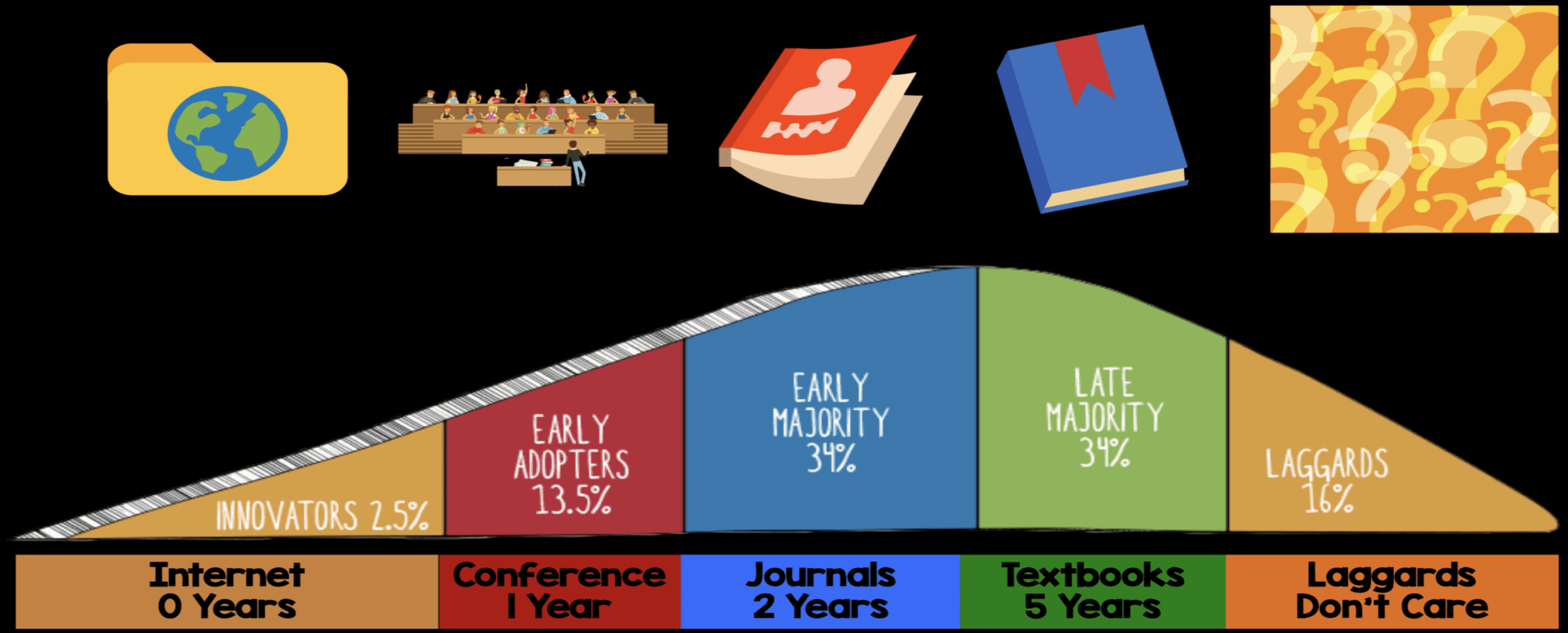
Standards and Guidelines for Cardiopulmonary Resuscitation (CPR) and Emergency Cardiac Care (ECC)



"... since 60% to 70% of sudden deaths caused by cardiac arrest occur before hospitalization, it is clear that the community deserves to be recognized as the ultimate coronary care unit."

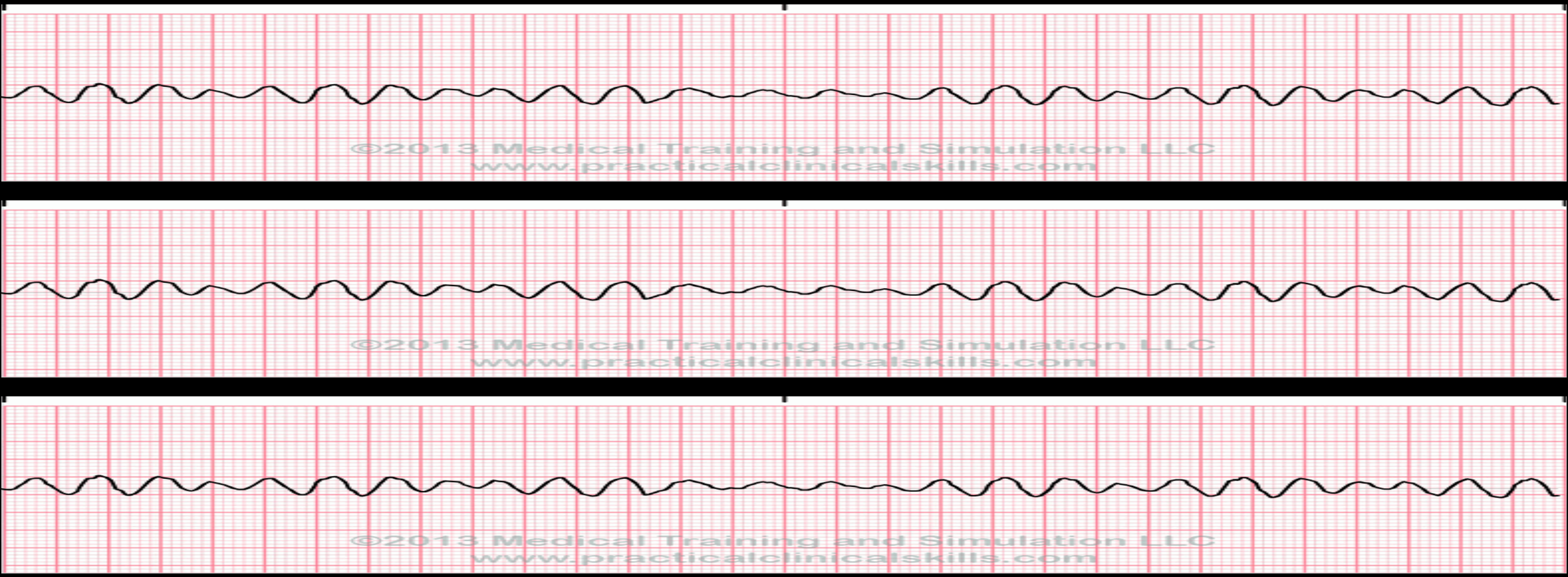
American Heart Association

ACLS isn't for resuscitationists



#FOAMed Thanks to Dr. Joe Lex

Refractory V-Fib (rVF)



Circulation

AHA STATISTICAL UPDATE

2024 Heart Disease and Stroke Statistics: A Report of US and Global Data From the American Heart Association

Seth S. Martin, MD, MHS, FAHA, Chair; Aaron W. Aday, MD, MSc, FAHA; Zaid I. Almarzooq, MBBCh, MPH; Cheryl A.M. Anderson, PhD, MPH, FAHA; Pankaj Arora, MD, FAHA; Christy L. Avery, PhD, MPH, FAHA; Carissa M. Baker-Smith, MD, MPH, FAHA; Bethany Barone Gibbs, PhD, MSc, FAHA; Andrea Z. Beaton, MD, MS, FAHA; Amelia K. Boehme, PhD, MSPH; Yvonne Commodore-Mensah, PhD, MHS, RN, FAHA; Maria E. Currie, MD, PhD; Mitchell S.V. Elkind, MD, MS, FAHA; Kelly R. Evenson, PhD, MS, FAHA; Giuliano Generoso, MD, PhD; Debra G. Heard, PhD; Swapnil Hiremath, MD, MPH, FAHA; Michelle C. Johansen, MD, PhD; Rizwan Kalani, MD; Dhruv S. Kazi, MD, MSc, MS, FAHA; Darae Ko, MD, MSc; Junxiu Liu, PhD; Jared W. Magnani, MD, MS, FAHA; Erin D. Michos, MD, MHSc, FAHA; Michael E. Mussolino, PhD, FAHA; Sankar D. Navaneethan, MD, MS, MPH; Nisha I. Parikh, MD, MPH; Sarah M. Perman, MD, MSCE, MS, FAHA; Remy Poudel, MS, MPH, CPH; Mary Rezk-Hanna, PhD, FAHA; Gregory A. Roth, MD, MPH, FAHA; Nilay S. Shah, MD, MPH, FAHA; Marie-Pierre St-Onge, PhD, FAHA; Evan L. Thacker, PhD; Connie W. Tsao, MD, MPH, FAHA; Sarah M. Urbut, MD, PhD; Harriette G.C. Van Spall, MD, MPH; Jenifer H. Voeks, PhD, FAHA; Nae-Yuh Wang, PhD, MS, FAHA; Nathan D. Wong, PhD, MPH, FAHA; Sally S. Wong, PhD, RD, CDN, FAHA; Kristine Yaffe, MD; Latha P. Palaniappan, MD, MS, FAHA, Vice Chair; on behalf of the American Heart Association Council on Epidemiology and Prevention Statistics Committee and Stroke Statistics Subcommittee

BACKGROUND: The American Heart Association (AHA), in conjunction with the National Institutes of Health, annually reports the most up-to-date statistics related to heart disease, stroke, and cardiovascular risk factors, including core health behaviors (smoking, physical activity, nutrition, sleep, and obesity) and health factors (cholesterol, blood pressure, glucose control, and metabolic syndrome) that contribute to cardiovascular health. The AHA Heart Disease and Stroke Statistical Update presents the latest data on a range of major clinical heart and circulatory disease conditions (including stroke, brain health, complications of pregnancy, kidney disease, congenital heart disease, rhythm disorders, sudden cardiac arrest, subclinical atherosclerosis, coronary heart disease, cardiomyopathy, heart failure, valvular disease, venous thromboembolism, and peripheral artery disease) and the associated outcomes (including quality of care, procedures, and economic costs).

AHA Stats

- Since 1950
  - Death rates CVD  60%
  - Recently trending back upward

AHA Stats

- Sudden Cardiac Arrest (OOHCA)
  - Survival to hospital DC 9.3% (2022 CARES)
  - 72.1% in the home

AHA Stats

- Awareness & Treatment
  - 40% OOHCA had layperson CPR (CARES 2022)

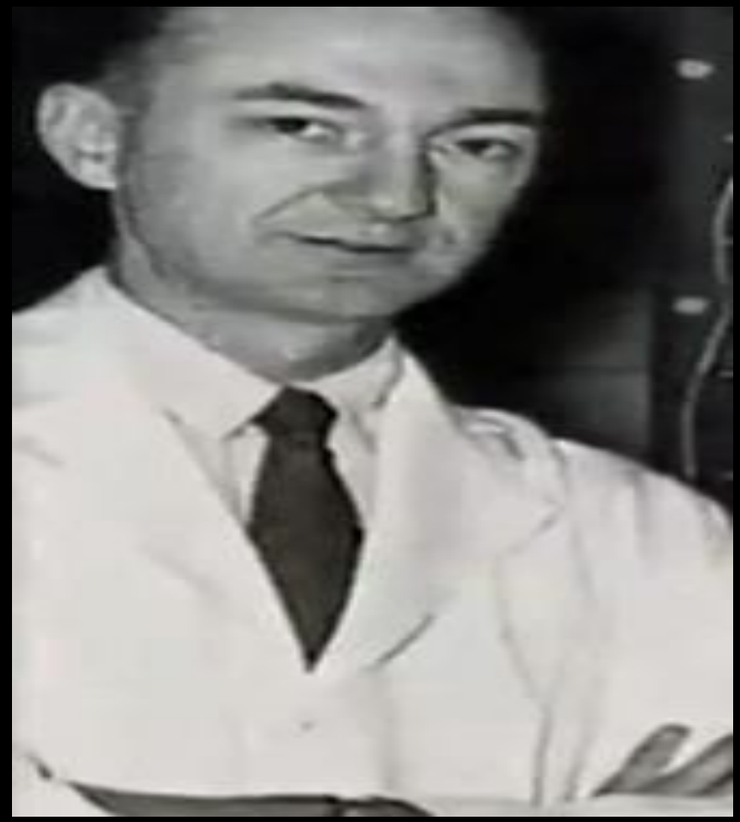
AHA Stats

- Mortality OOHCA (CARES 2022)
  - Hospital admission survival 24.9%
  - Hospital DC survival 9.3%
  - Good functional DC 7.5%

Jude, Kouwenhoven, & Knickerbocker

Dr. Jude

- Manual pressure to chest could restore cardiac output



Dr. Kuonhoven

- 1928 – ConEd Study
- 1933 – Discovered defibrillation (dog)
- 1933-1947 – Defib open chest
- 1951 – Closed chest defib

1957 – 200# prototype

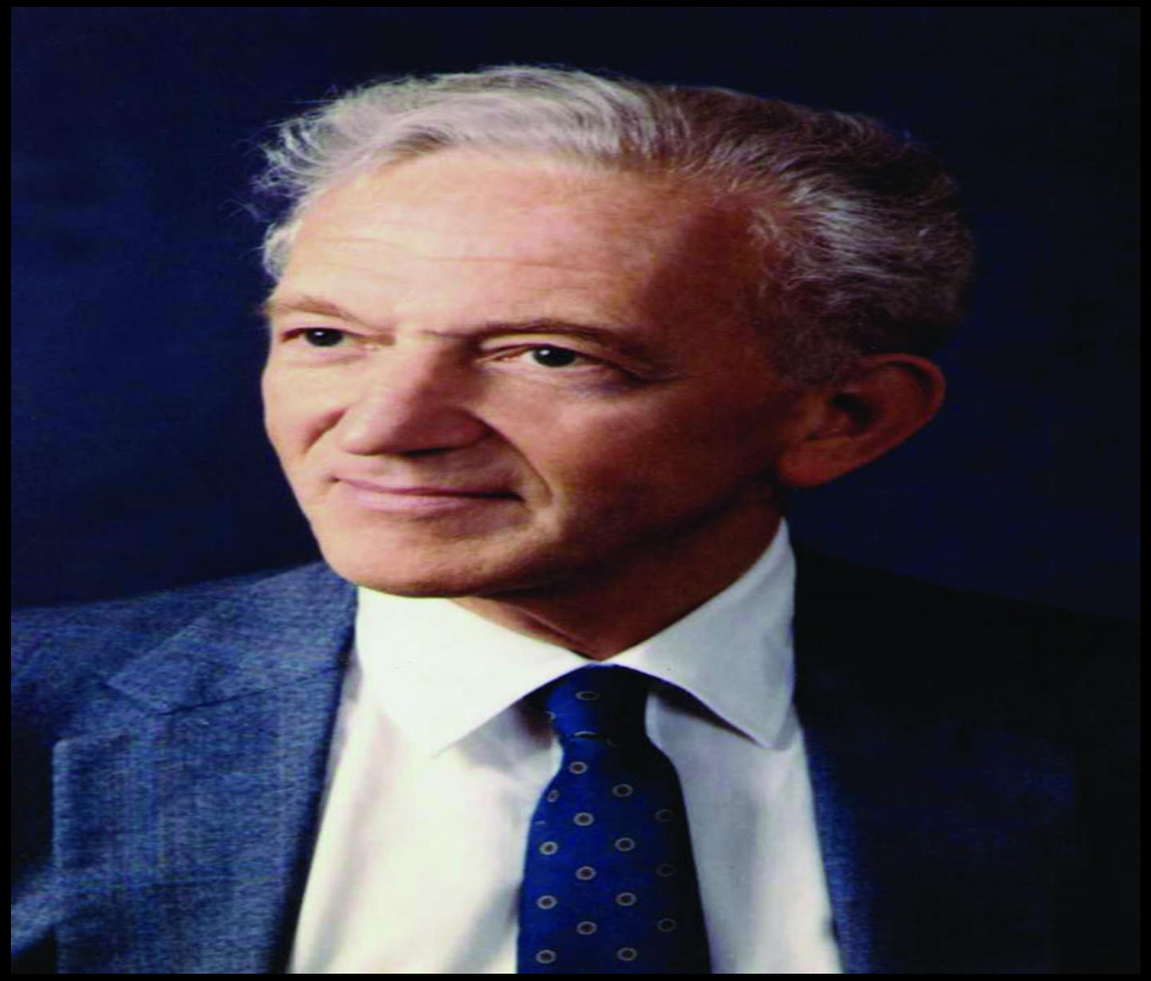
March 17 – First human defibrillation closed chest

1959-1960 – 20 patients resucitated with closed chest CPR

Dr. Knickerbocker

- 1954 – Joins Dr. Kuonhoven

Safar “Father of Modern CPR” & Hinds “Are My Intentions Honorable”



Achieving VF Success

- High Quality CPR
- Optimize defibrillation
- ? Redirect Defibrillation Wave
- Stabilize the Myocardium

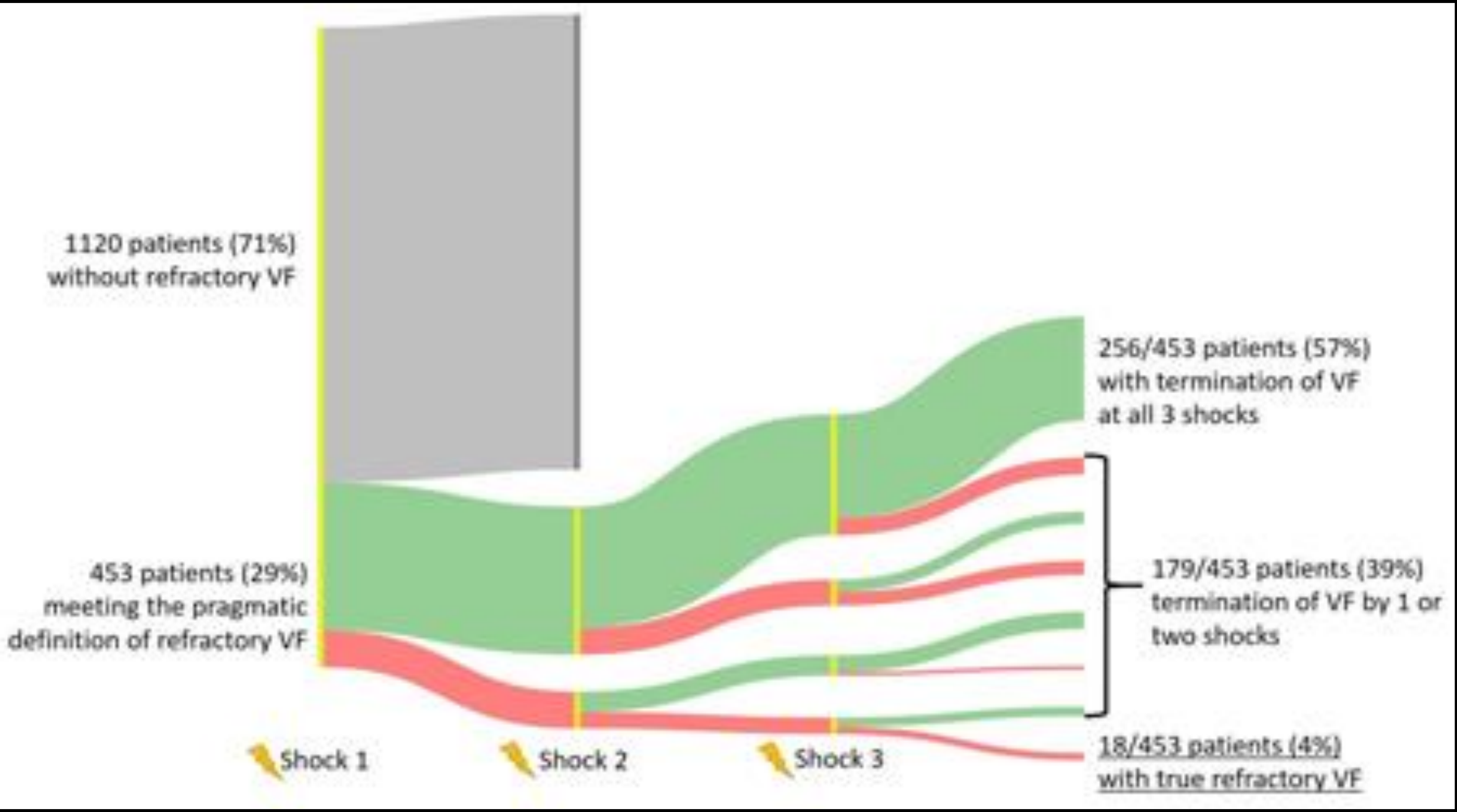
Out-of-Hospital Cardiac Arrest

- > 350,000/year OOHCA
- ~80,000/year due to VF/VT
- VF/VT “shock refractory”
  - Recurrent (post shock) or incessant (not terminated by shock)
- Shock refractory associated with decreased survival

Recurrent vs Refractory VF

- **Recurrent**
  - Defibrillation terminates VF
  - VF returns
  - Not a defibrillation issue

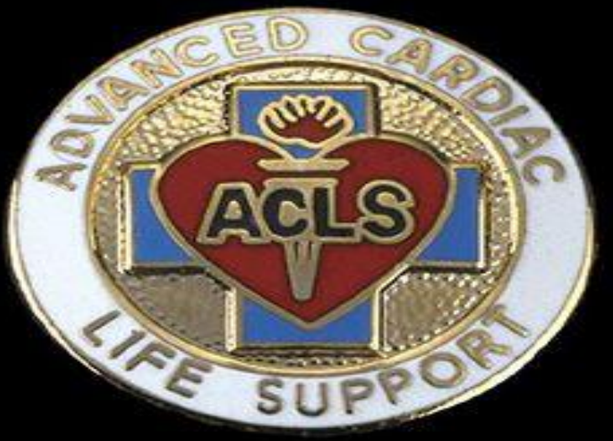
- **Refractory**
  - Defibrillation does not terminate VF
  - VF persists
  - Defibrillation issue


1120 patients (71%)
without refractory VF
453 patients (29%)
meeting the pragmatic
definition of refractory VF
256/453 patients (57%)
with termination of VF
at all 3 shocks
179/453 patients (39%)
termination of VF by 1 or
two shocks
18/453 patients (4%)
with true refractory VF
Shock 1
Shock 2
Shock 3

ACLS

American Heart Association

ACLS



ADVANCED CARDIOVASCULAR LIFE SUPPORT

ACLS Provider

American Heart Association®

This card certifies that the above individual has successfully completed the cognitive and skills evaluations in accordance with the curriculum of the American Heart Association Advanced Cardiovascular Life Support (ACLS) Program.

Issue Date

Recommended Renewal Date

ADVANCED CARDIOVASCULAR LIFE SUPPORT

Training Center Name

TC ID #

TC Info

City, State

ZIP

TC Phone

Course Location

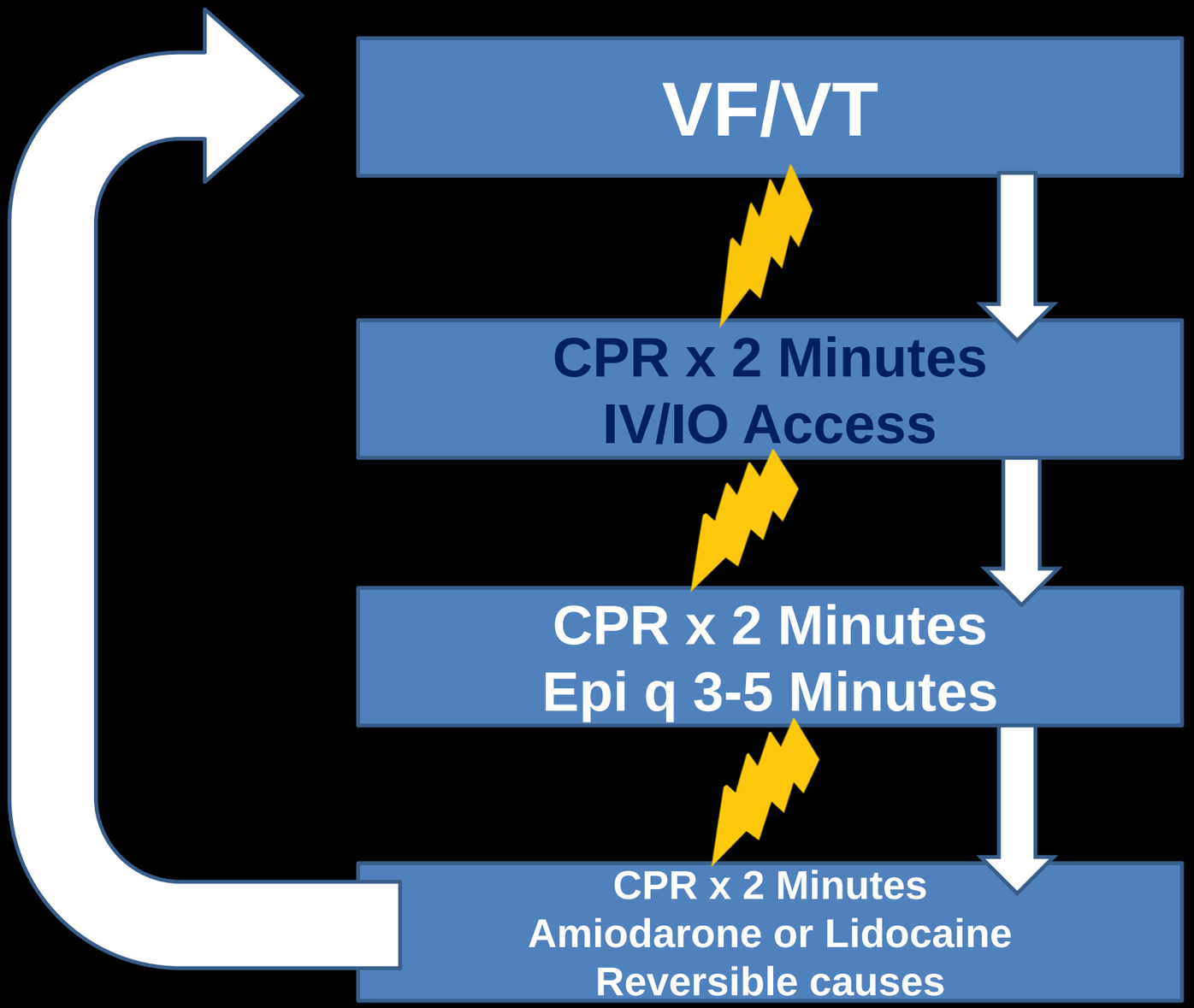
Instructor Name

Inst. ID #

Holder's Signature

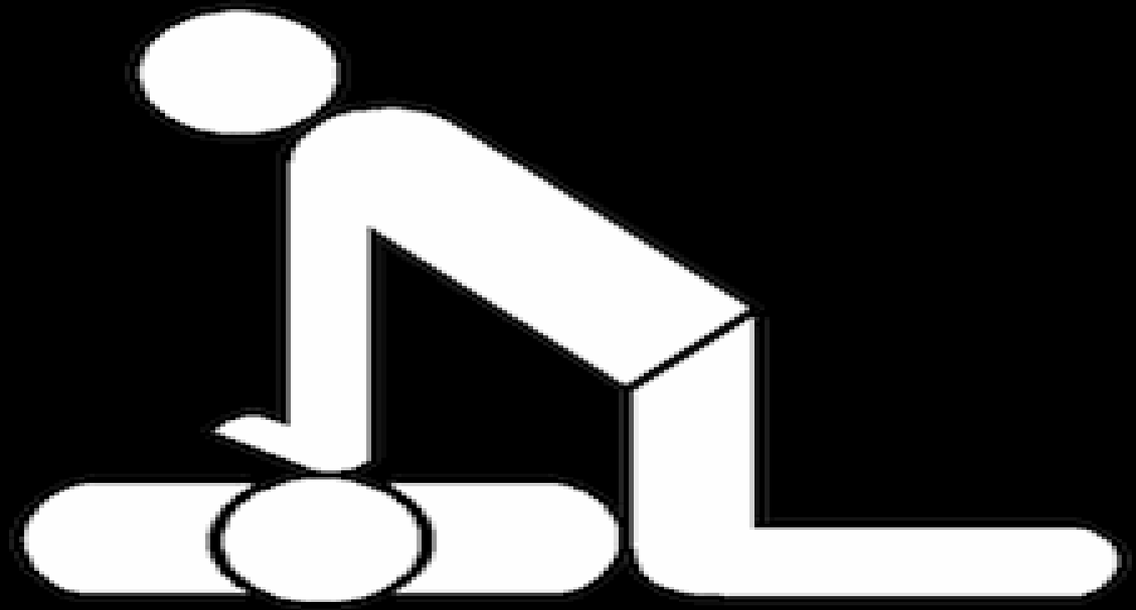
 Tampering with this card will alter its appearance. 90-1806

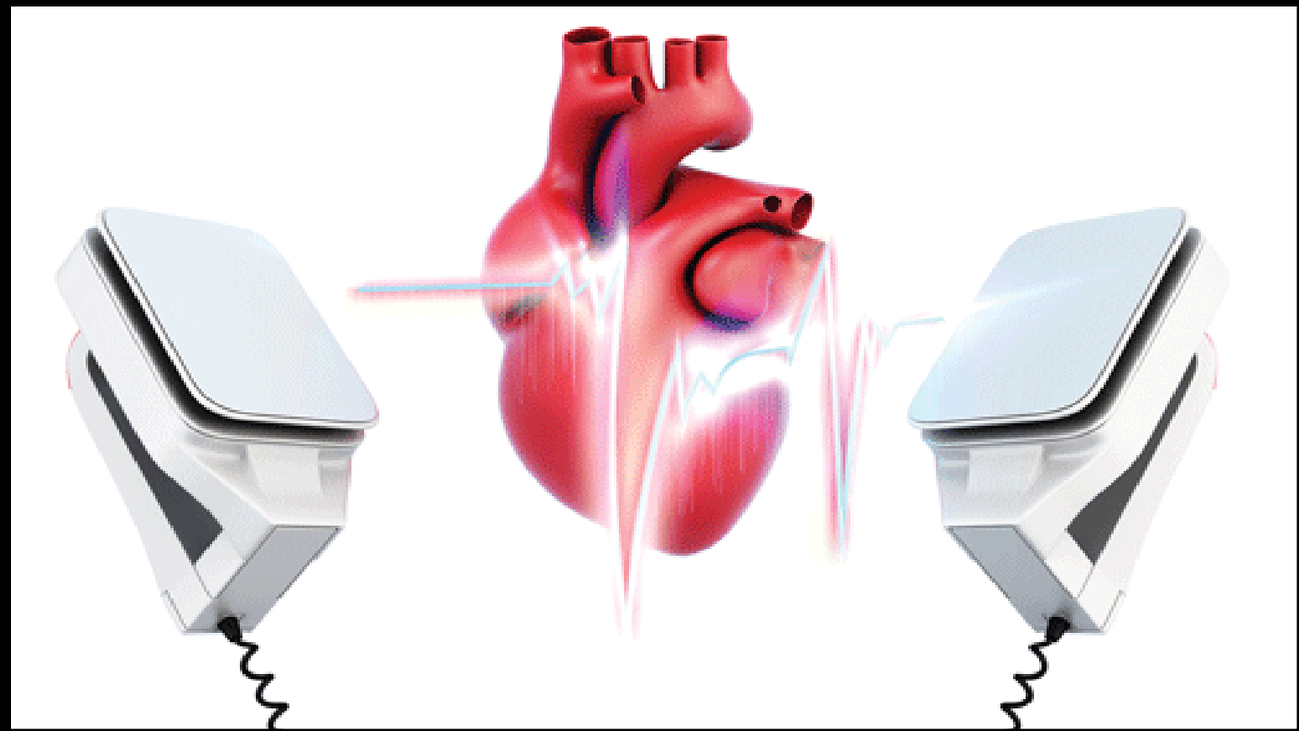
ACLS

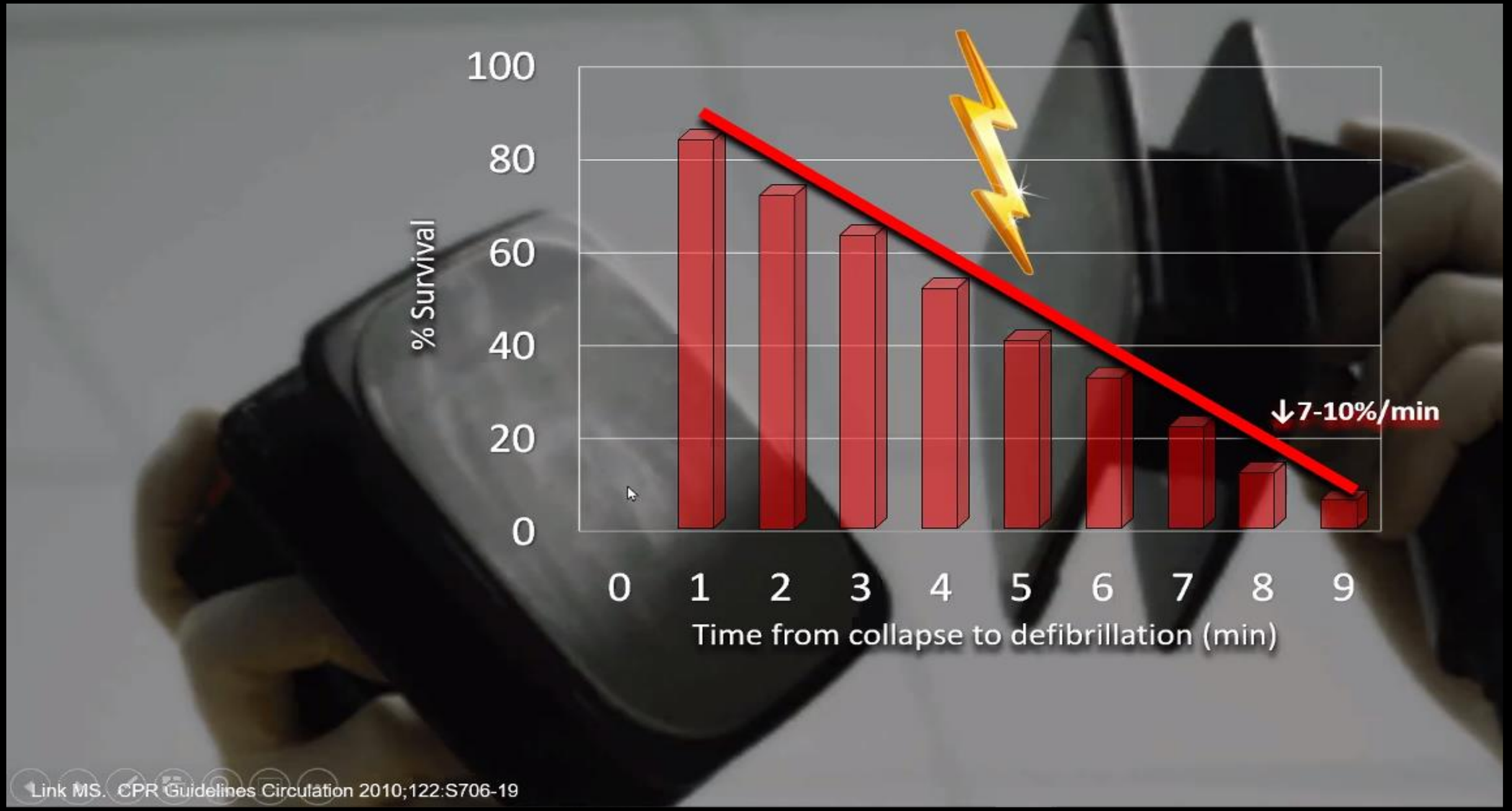

VF/VT
CPR x 2 Minutes
IV/IO Access
CPR x 2 Minutes
Epi q 3-5 Minutes
CPR x 2 Minutes
Amiodarone or Lidocaine
Reversible causes

Strategies for rVF

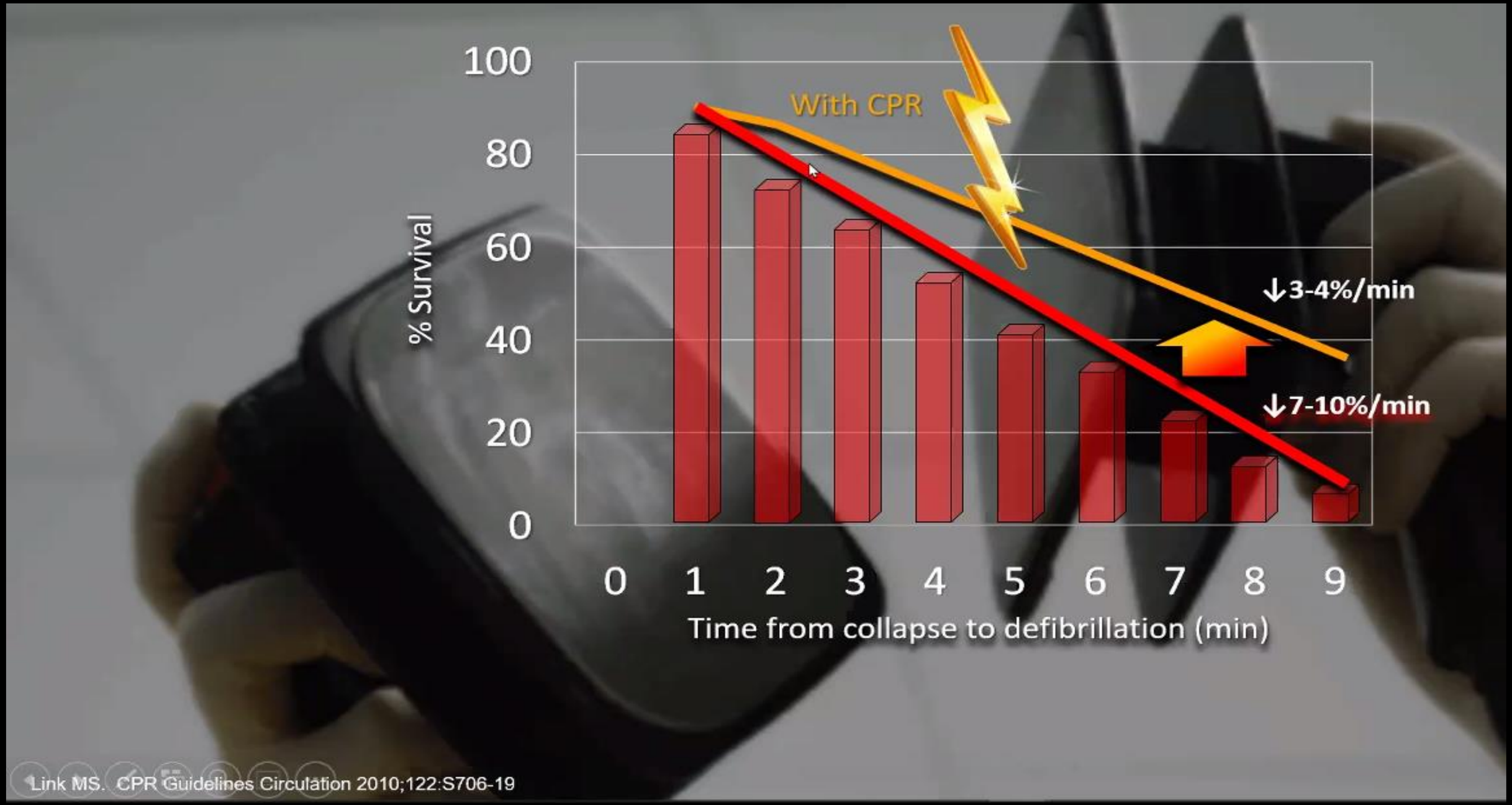
Strategies		Effect
High performance CPR	→	Optimize blood flow
Defibrillation	→	Terminate VF







Link MS. CPR Guidelines Circulation 2010;122:S706-19

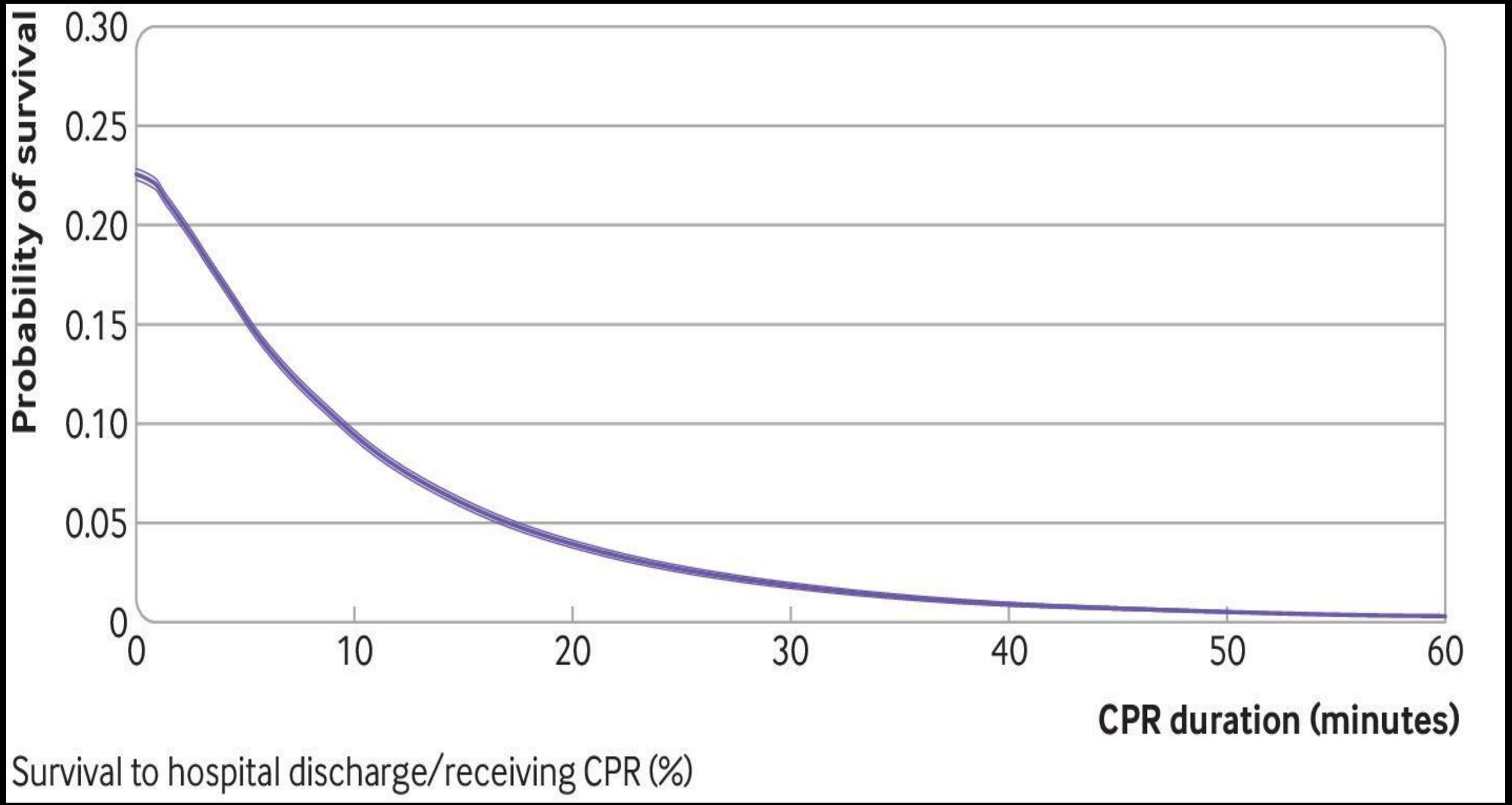


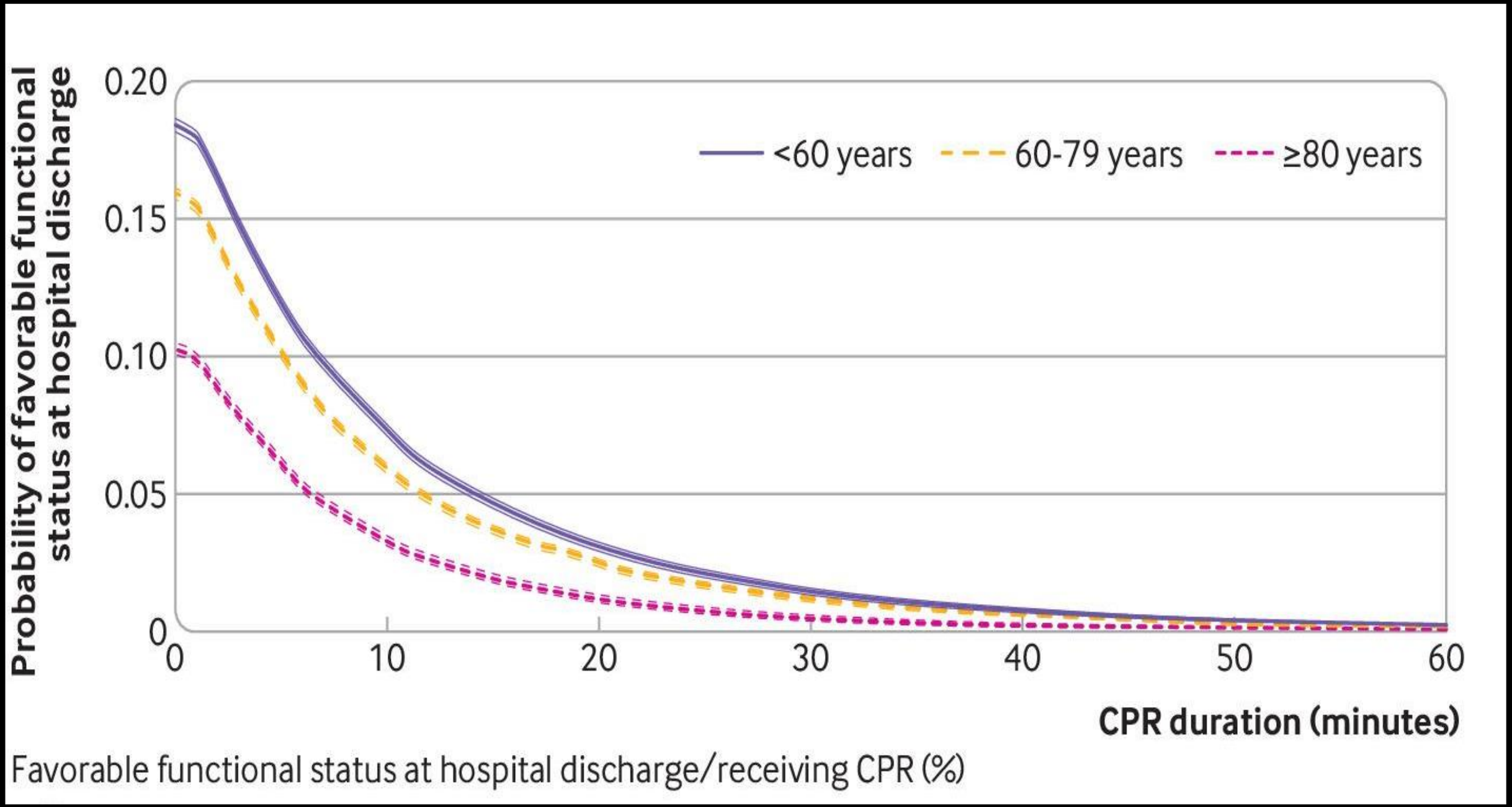
Link MS. CPR Guidelines Circulation 2010;122:S706-19

More Recent CPR Data

- CPR's ability to resuscitate diminishes quickly
- Odds of surviving despite CPR decline from 22% after one minute to less than 1% after 39 minutes
- About two-thirds of patients responded to CPR within an average seven minutes

SOURCE: Duration of cardiopulmonary resuscitation and outcomes for adults with in-hospital cardiac arrest: retrospective cohort study.
BMJ 2024; 384 doi: https://doi.org/10.1136/bmj-2023-076019 (Published 07 February 2024)


Probability of survival
0.30
0.25
0.20
0.15
0.10
0.05
0
0
10
20
30
40
50
60
CPR duration (minutes)
Survival to hospital discharge/receiving CPR (%)



Favorable functional status at hospital discharge/receiving CPR (%)

Time to ***Stop***

- **Shockable**
  - **30 minutes**

- **Non-Shockable**
  - **15minutes**

- **Unless**
  - **Refractory shockable AND destination care**


I can't keep doing this forever.
It's been 20 seconds.
Call it.

2022 AHA Guidelines

- **Deliver resuscitation AT SCENE rather than transport *unless***
  - **ECMO**
  - **Cath Lab**


MIKEY JOHN @ NOT
ALL SUPERHEROES
WEAR CAPES
WHEN YOU ARE WAITING FOR THAT CARDIAC
ARREST PRENOTIFICATION TO ARRIVE TO YOUR ER

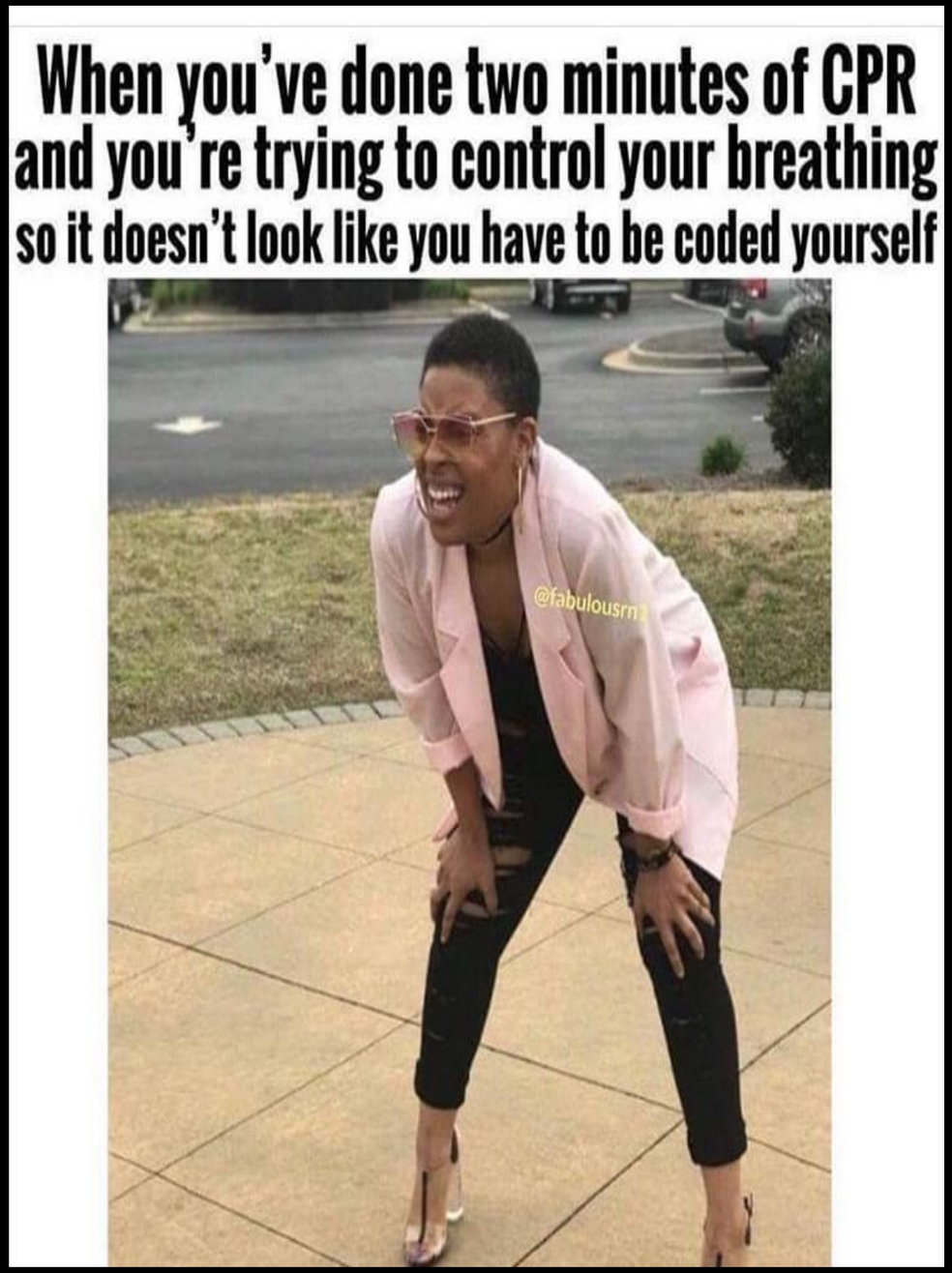
SGEM Transport vs Scene

	Transport	On Scene
ROSC	15.8%	48.3%
DC Alive	3.8%	12.6%
DC Good Neuro (mRS <3)	2.6%	10.2%

What Works?

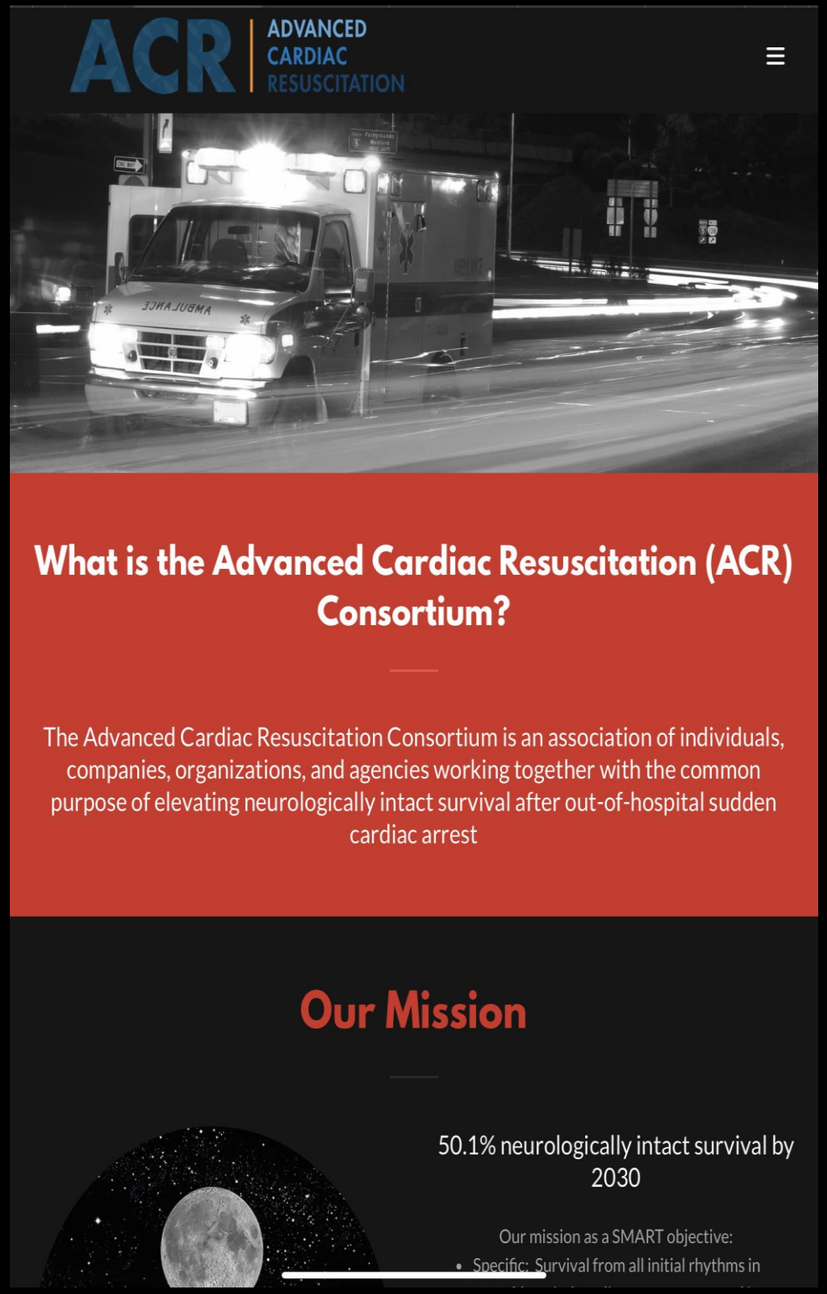
High Quality CPR

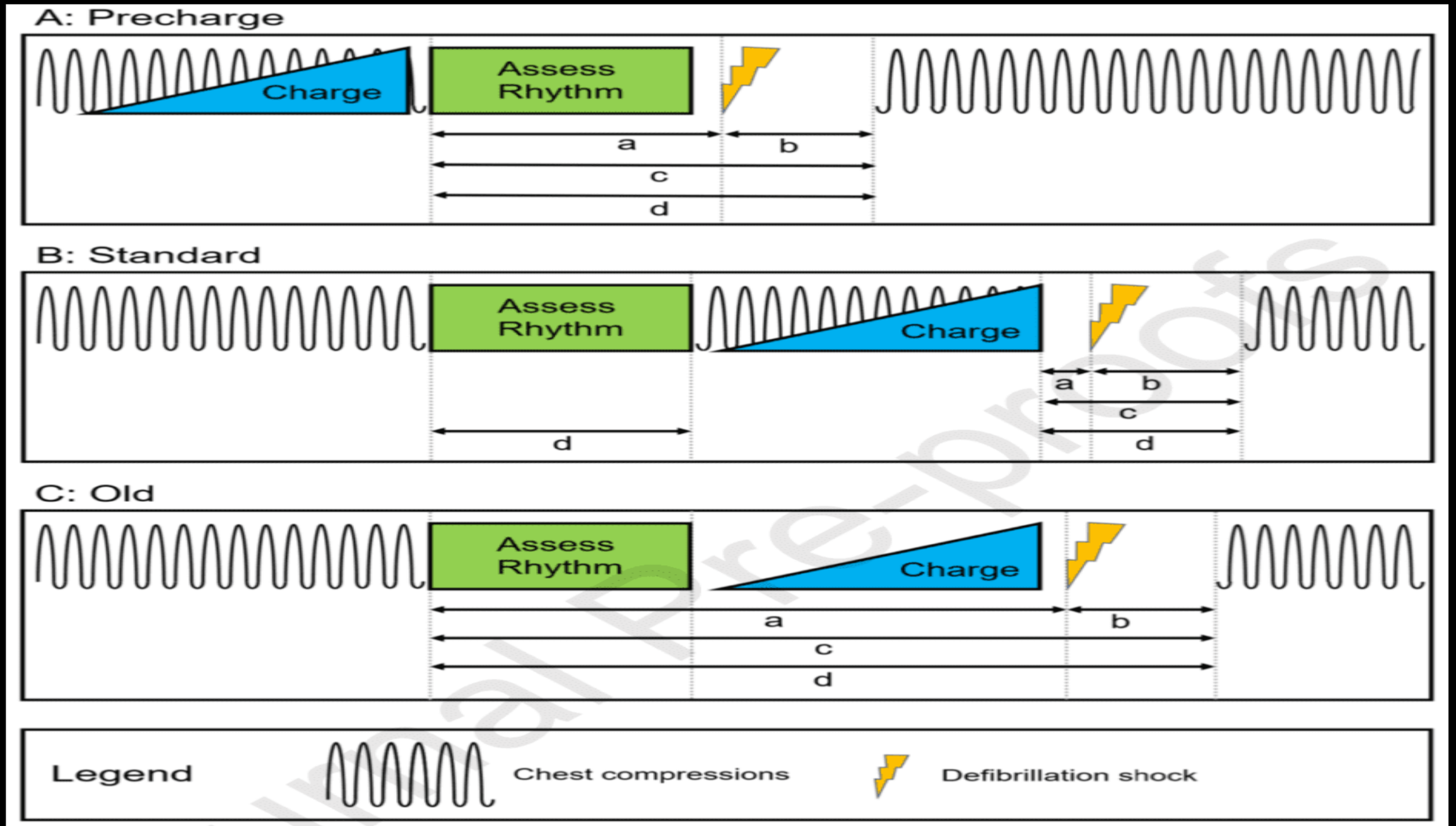
- **Push Hard**
- **Push Fast – 100 to 120 compressions/minute**
- **Allow for full chest recoil**
- **Limit interruptions/pauses**

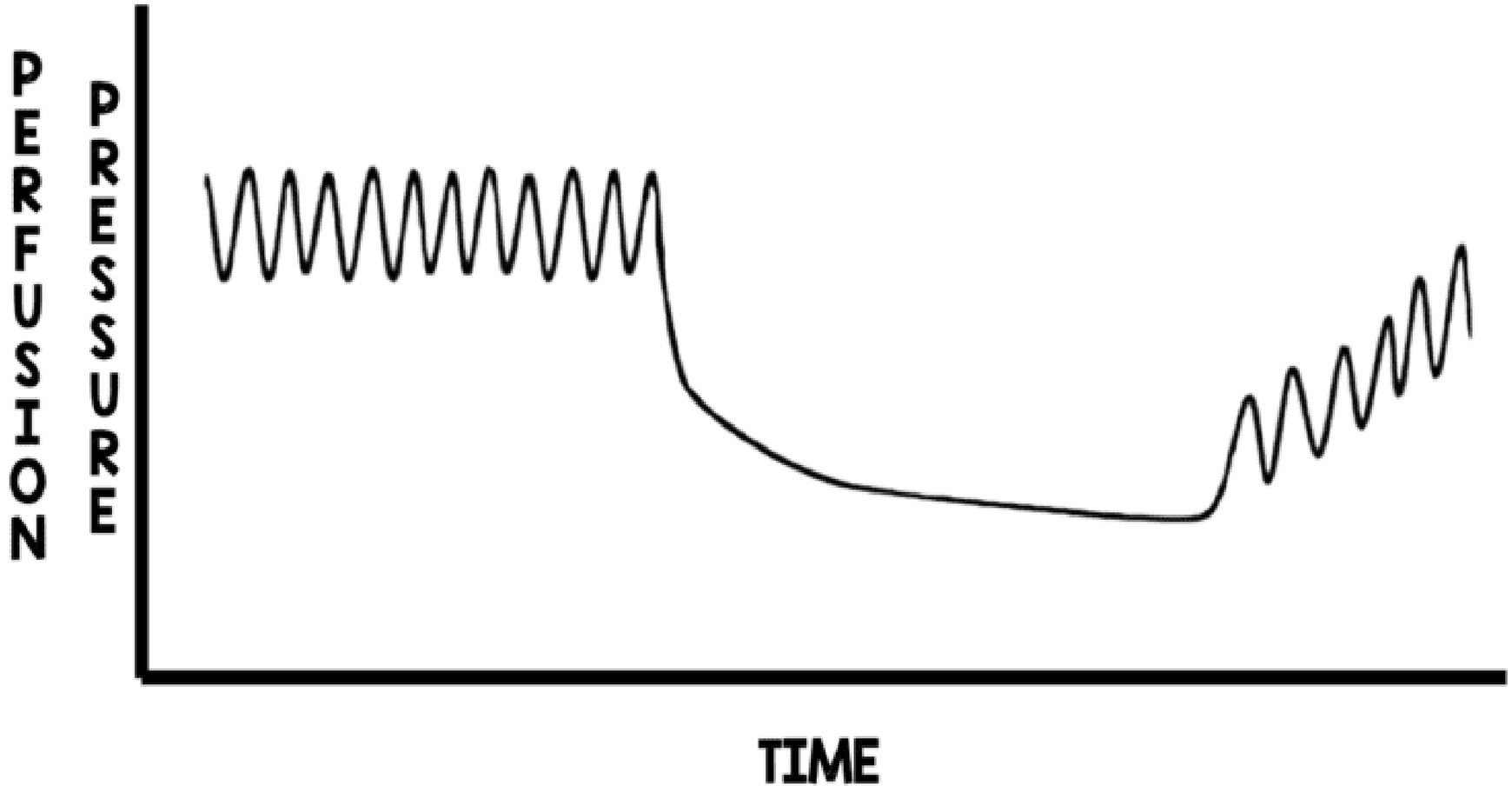


2022 AHA Guidelines

- CPR fraction > 60%
  - (ACR 95%!!)
- Minimize peri-shock pauses




A: Precharge
Charge
Assess Rhythm
a
b
c
d
B: Standard
Assess Rhythm
Charge
a
b
c
d
d
C: Old
Assess Rhythm
Charge
a
b
c
d
Legend
Chest compressions
Defibrillation shock



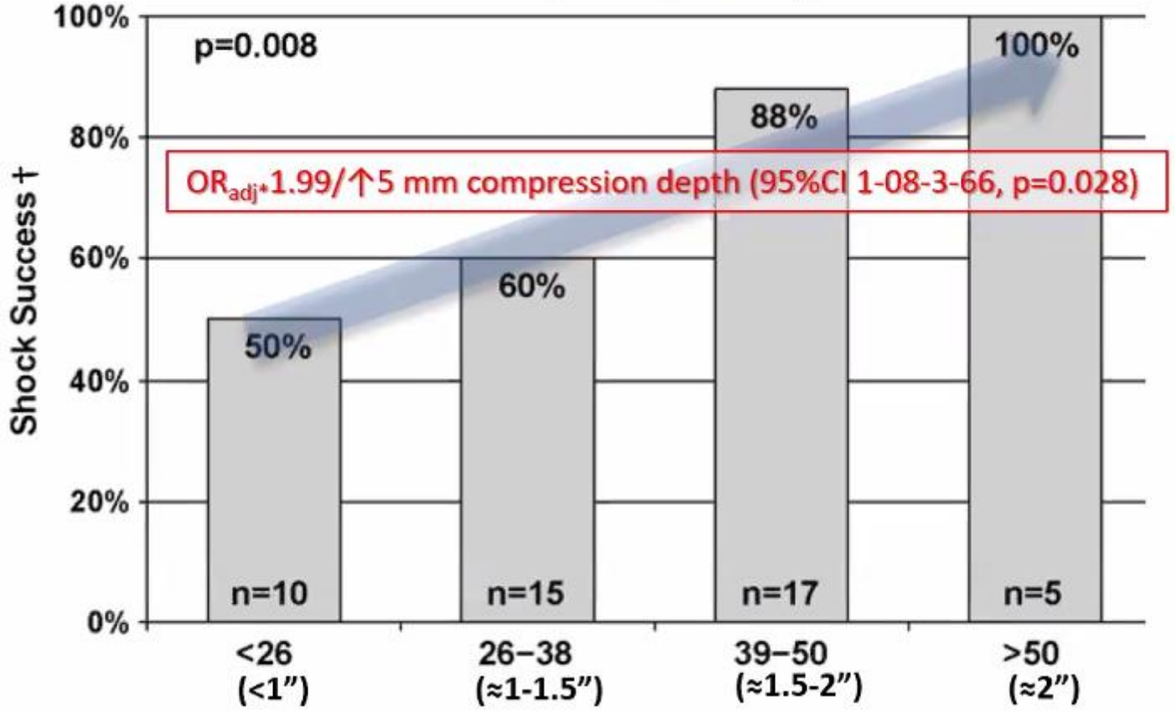
PAUSE = Decreased Perfusion

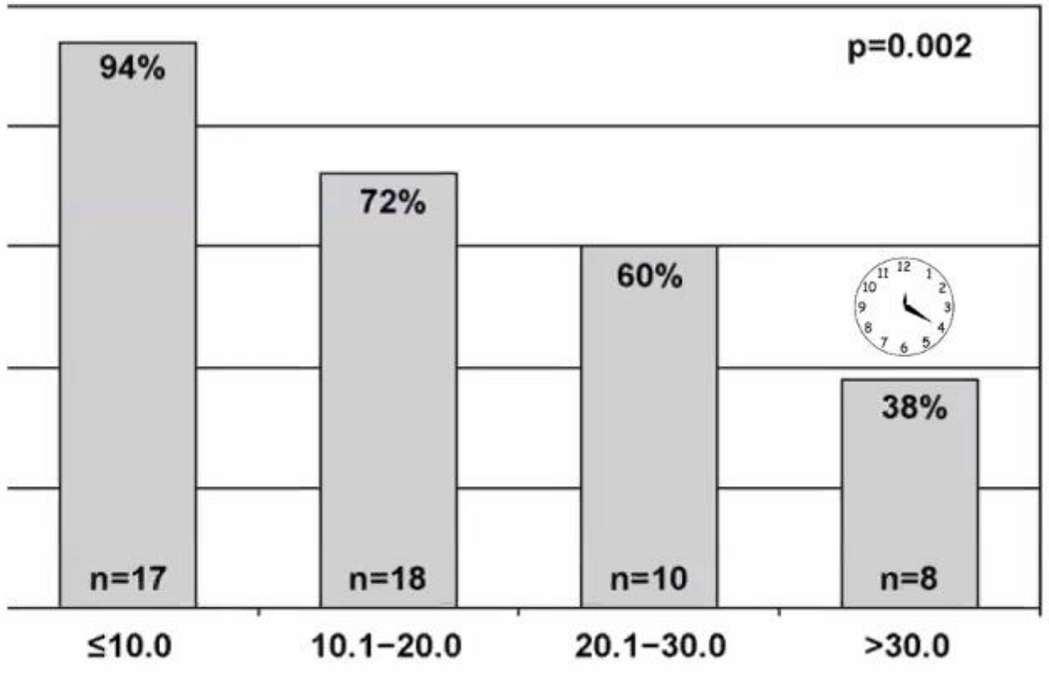
CPR Depth and Pre-Shock Pause

n= 60 adults VF/1st shock @ $\overline{3.7}$ min

Compression Depth

Hands-off Time





Edelson DP et al. Resuscitation 2006;71:137-45

†Shock success = VF termination ≥ 5 sec post shock

- With ventilation rate standardized, chest compression (CC) depth explains variations in ETCO2 better than chest compression rate.

- Don’t forget that **higher CPR ETCO2 predicts ROSC**!!

Defibrillation

Defibrillation

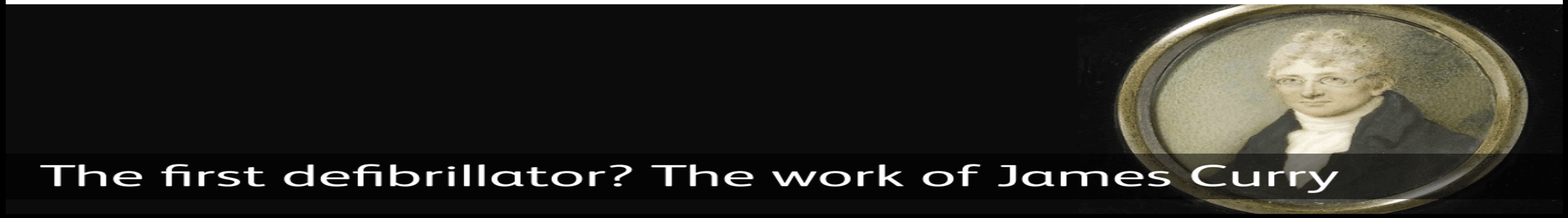
Humane Society 1774

"The Institute for Affording Immediate Relief for Persons Apparently Dead from Drowning"

(TIFAIRFPADFD)

- **www.trauma.org**

Royal College of Physicians



“A 3 year-old girl, Sophie Greenhill, was pronounced dead after a fall. Mr. Squires tried the effects of electricity. Delivered shocks to various parts of the body, upon transmitting shocks through the thorax, he perceived a small pulsation, in a few minutes the child began to breathe.”

A Tennessee husband and father died on Thanksgiving after flames burst over his body when hospital staff used defibrillator paddles

Katie Balevic Dec 3, 2022, 11:43 AM

Defibrillator. Getty Images

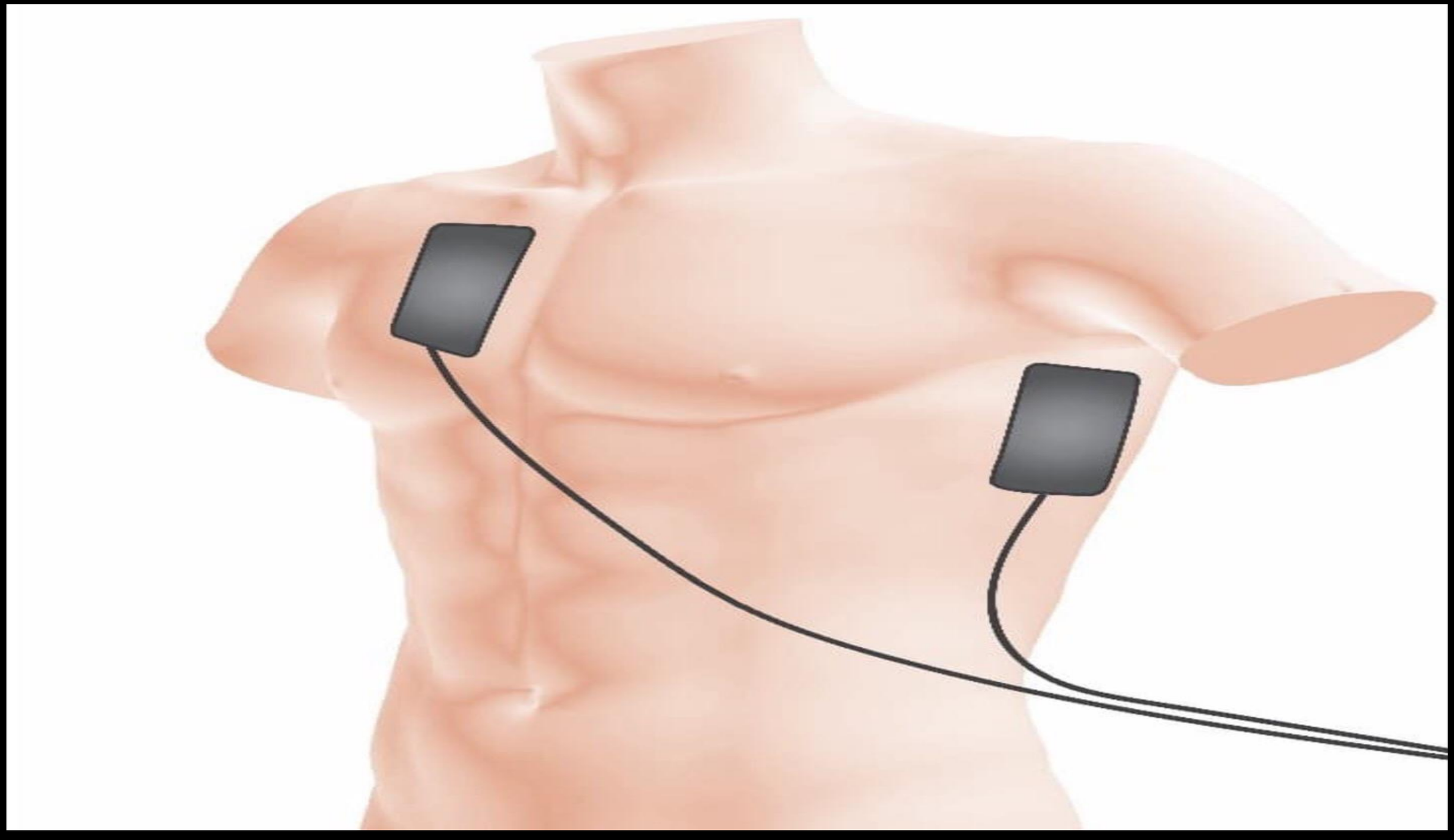
- **A Tennessee man died after he caught on fire while hospital staff used a defibrillator on him.**
- **The man's wife was in the room when her husband caught ablaze, telling WKRN that "it just blew up."**

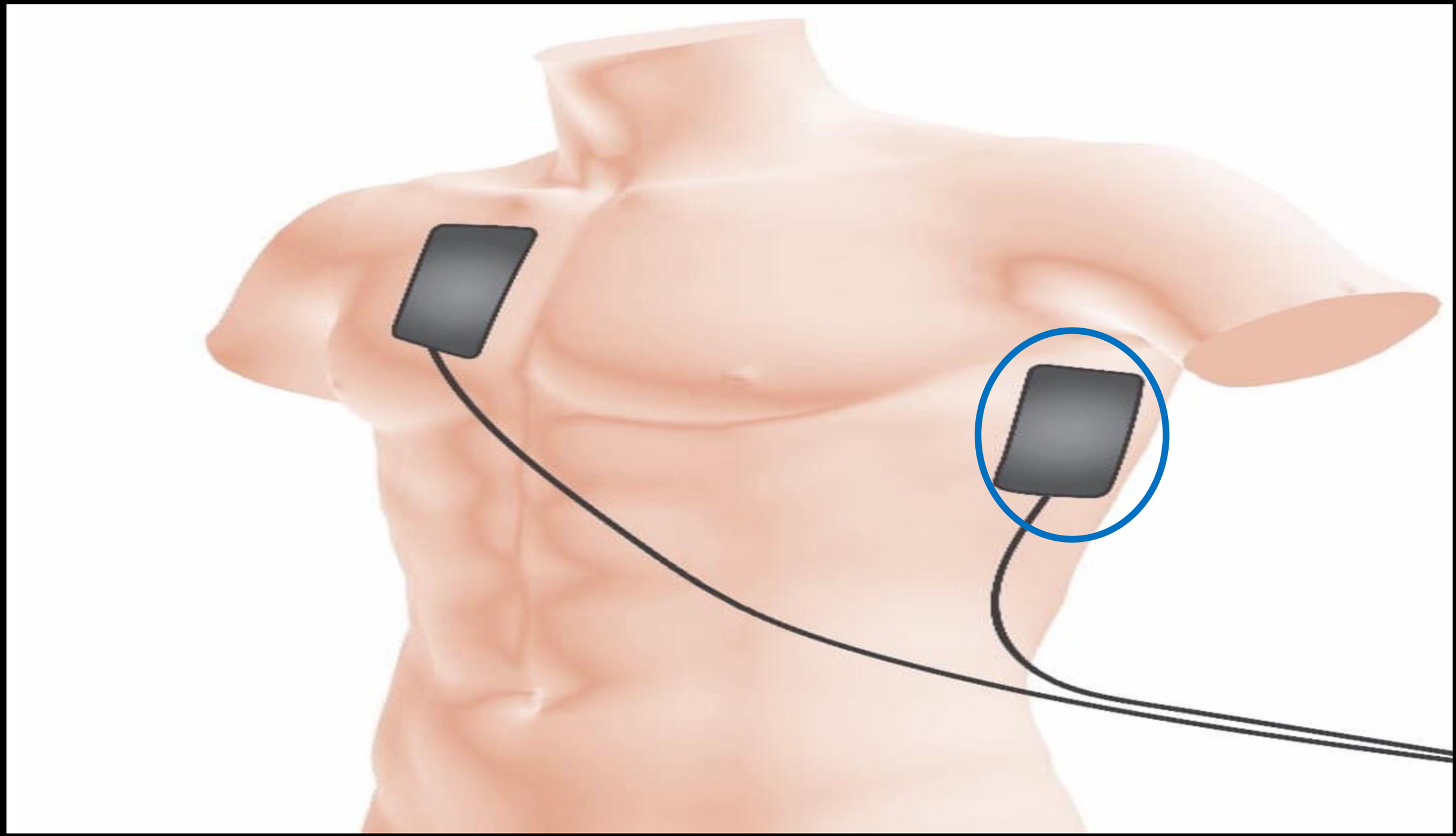
Accidental "Cranial" Defibrillation

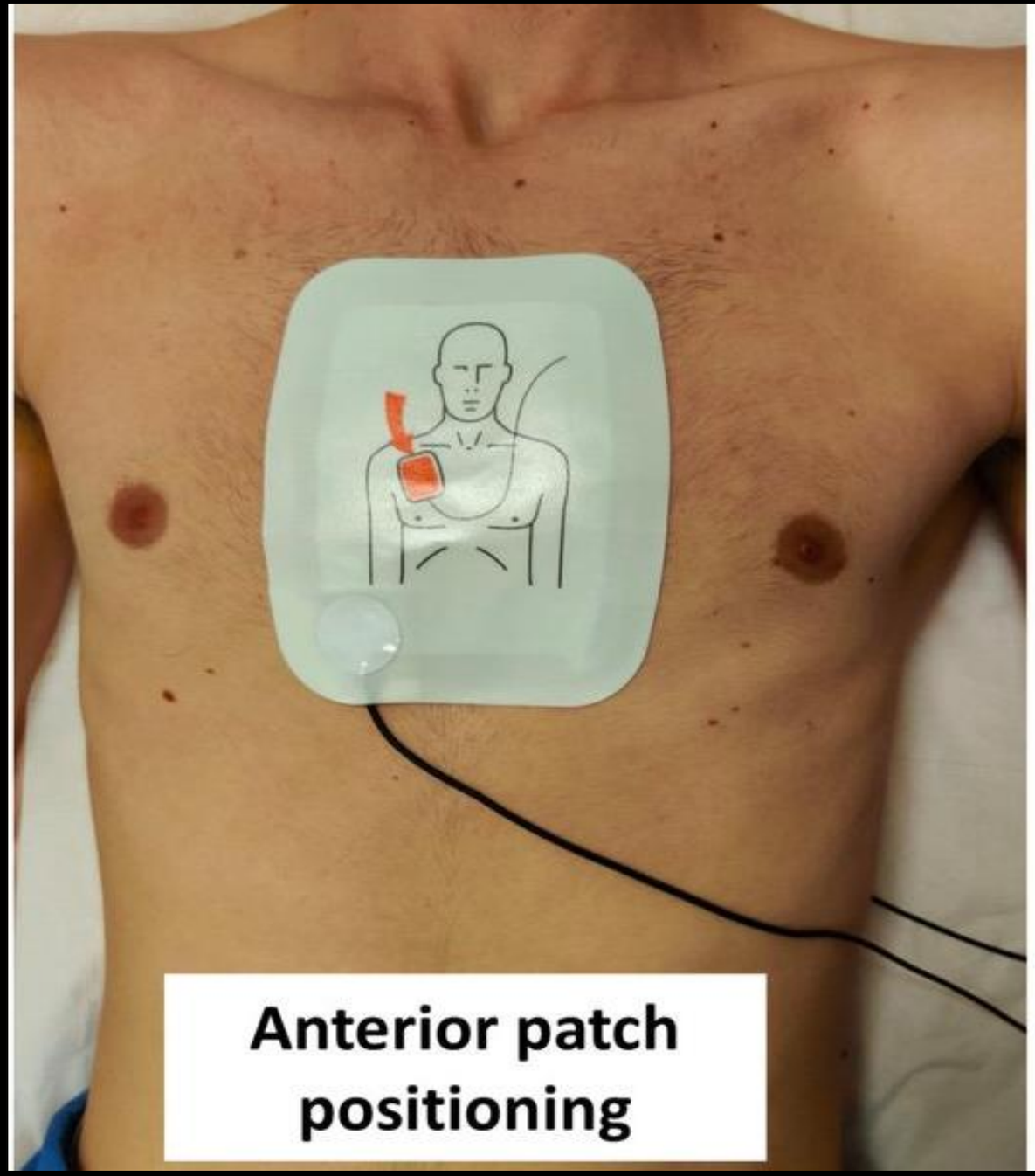
Kenneth V. Iserson, MD
William George Barsan, MD
Cincinnati, Ohio

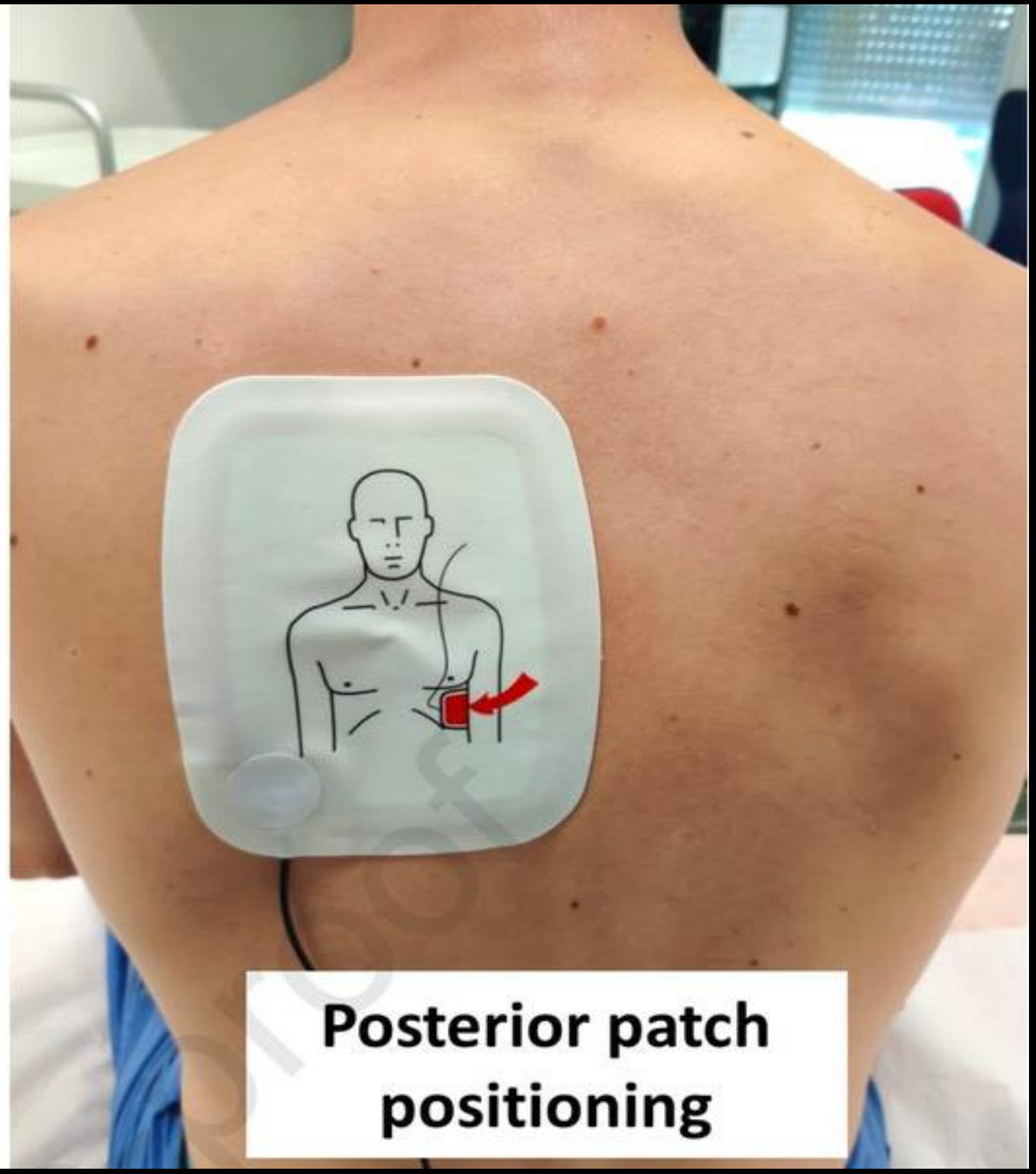
A case of accidental shock to the head, caused by a cardiac defibrillator, is presented. The shock resulted in minor burns and symptoms similar to those of postelectro-convulsive shock therapy (ECT). A physician participating in an advanced life support course, and familiar with the equipment, was the victim. An assumption that the demonstration equipment was not real seems to have been the cause of the accident. Suggestions for prevention of further episodes are discussed. Iserson KV, Barson WG: Accidental "cranial" defibrillation. *JACEP* **7**:24-25, January, 1979.
defibrillators, injury, head

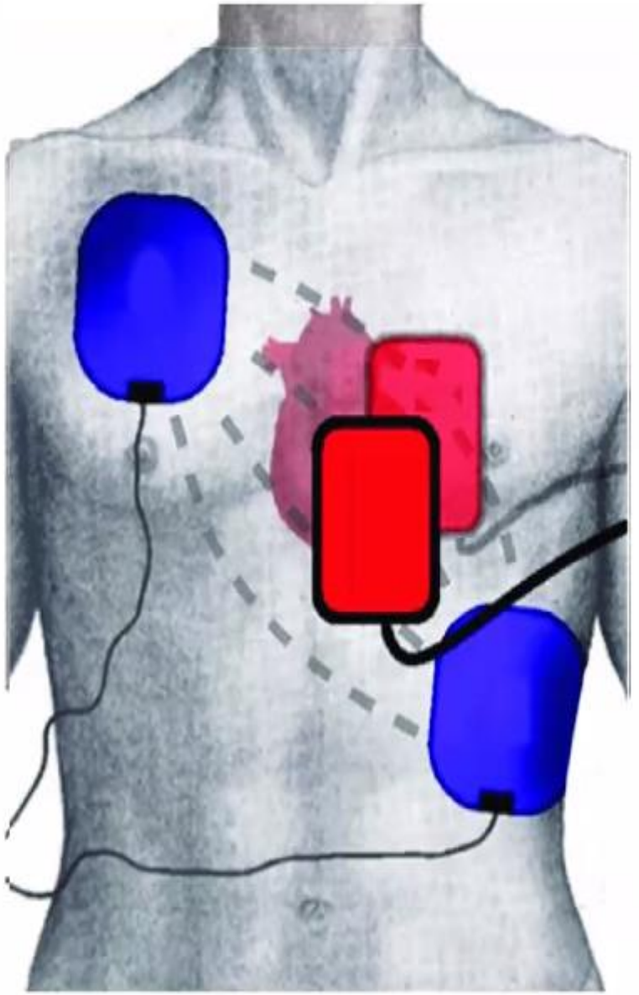

LIFEPAK 15 MONITOR/DEFIBRILLATOR
PHYSIO CONTROL
13:31:59
69
99
38
107
70
85
12-LEAD
TRANSMIT
CODE SUMMARY
PRINT
ON
CPR
ANALYZE
LEAD
SIZE
SYNC
NIBP
ALARMS
OPTIONS
EVENT
ENERGY SELECT
CHARGE
PACER
RATE
CURRENT
PAUSE
HOME SCREEN
SPEED DIAL
DANGER Explosion hazard. Do not use in the presence of flammable gases.
WARNING Hazardous electrical output. For use only by qualified personnel.

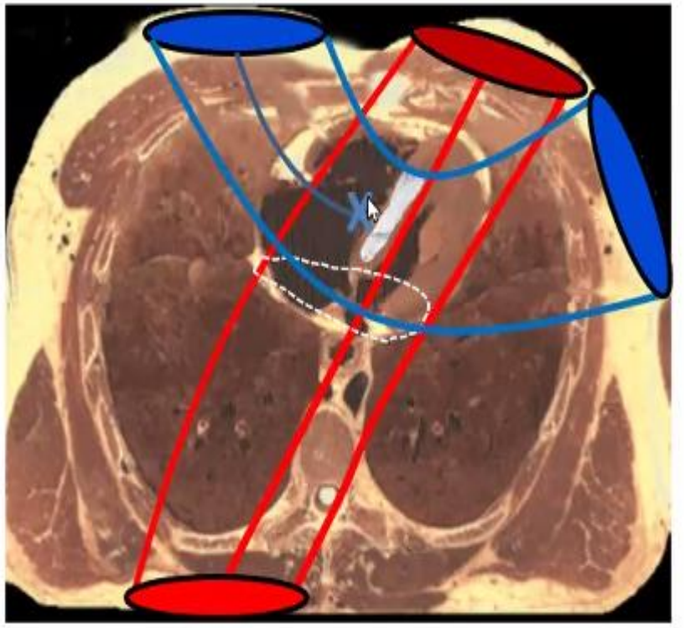


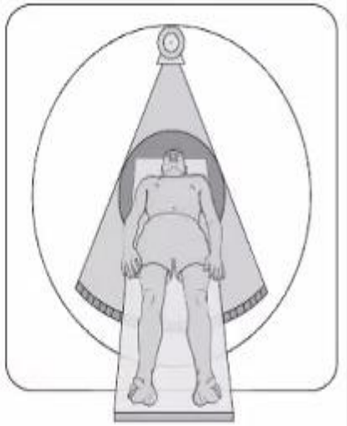



Anterior patch positioning


Posterior patch positioning







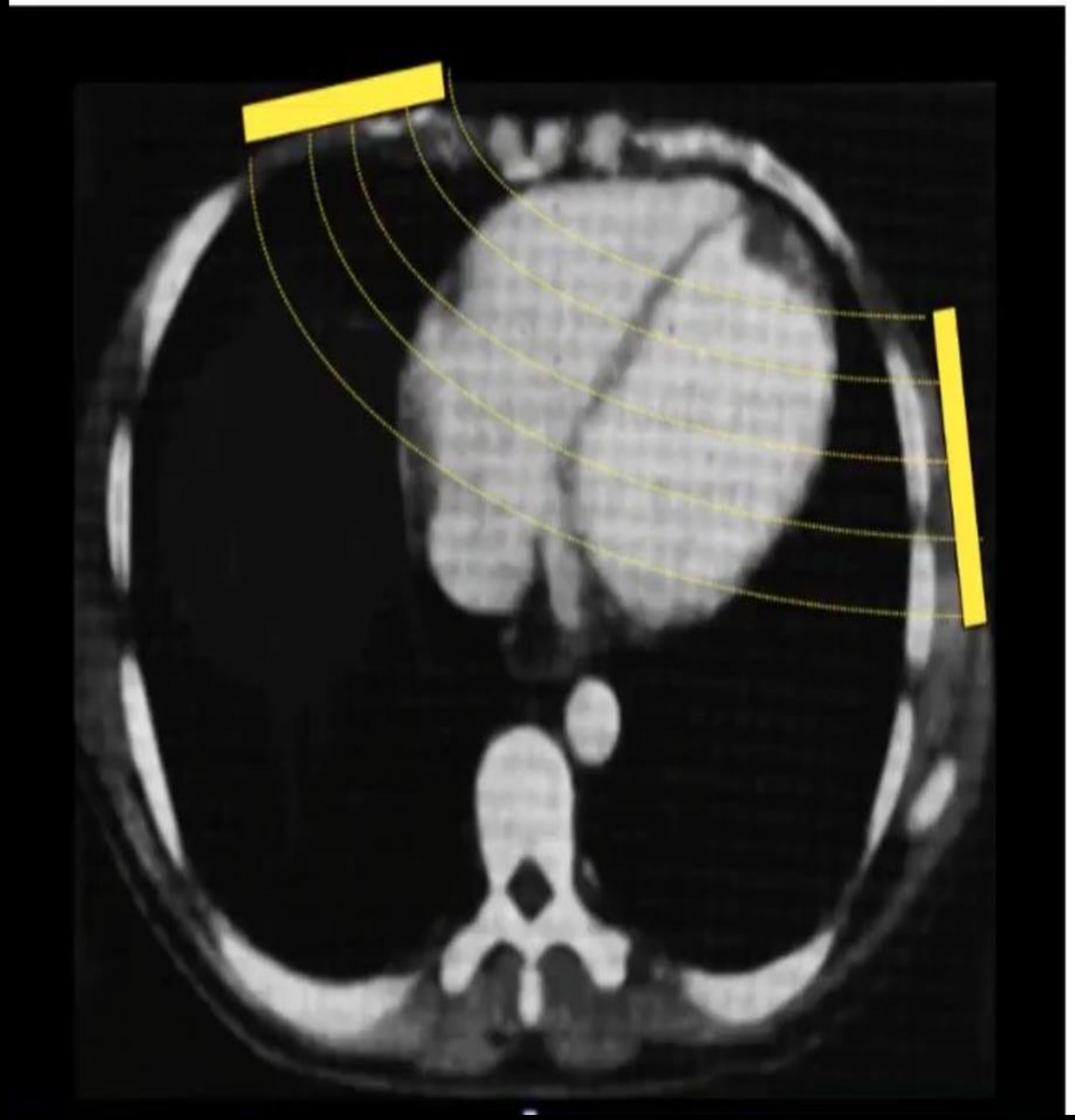
Antero-lateral

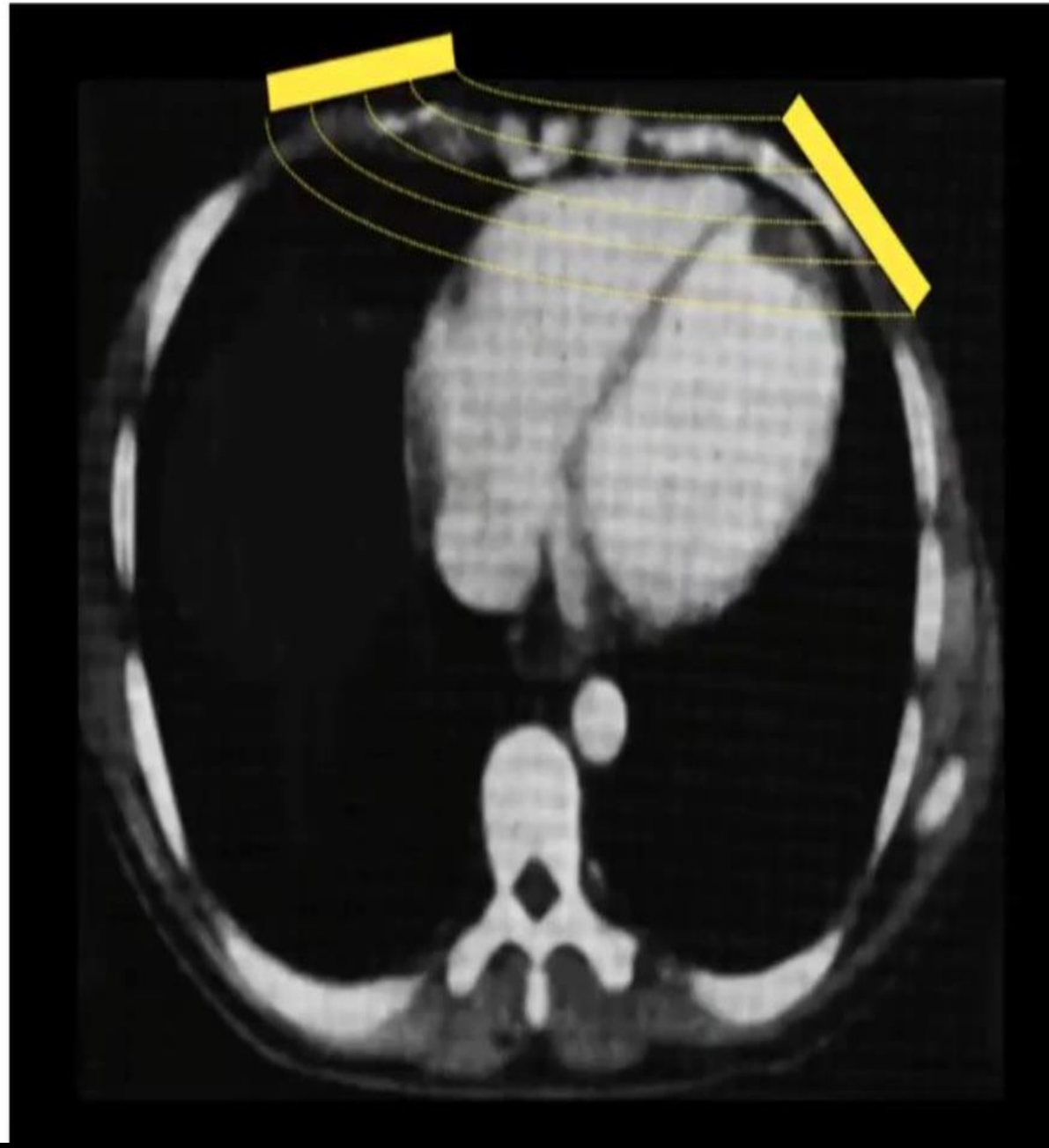
- Anterior electrode just to the right of the sternal border below the clavicle & above nipple
- Lateral electrode to the left & below nipple centered in the mid axillary line

Antero-posterior

- Anterior electrode over left precordium
- Posterior electrode just inferior to left or right scapula

International Resuscitation Council. Guidelines. Resuscitation 2000;46:109–13





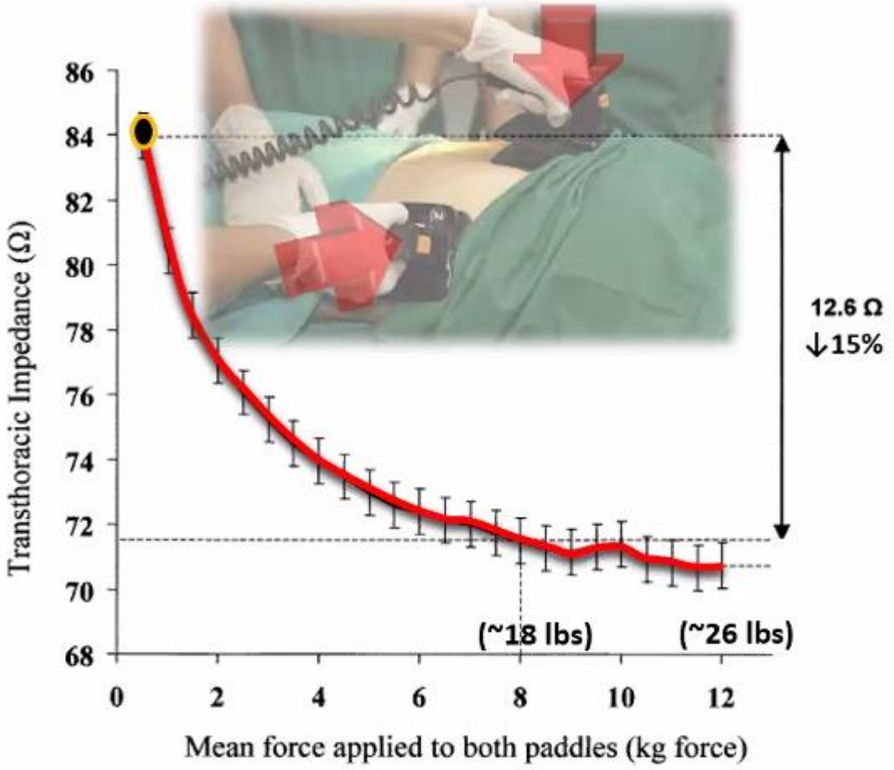

STERNUM
APEX
FRONT

Determining the Optimal Paddle Force for External Defibrillation

Charles D. Deakin, MD, Daniel M. Sado, BSc, Graham W. Petley, BSc, PhD, and Frank Clewlow, BSc

n = 55 adults (39 men 16 women)

- Adult defib paddles (81.5 cm^2)
- 0.5 kg vs 0.5 kg force increments
- 1 kg = 2.2 lbs



Effect of Application of Force to Self-Adhesive Defibrillator Pads on Transthoracic Electrical Impedance and Countershock Success

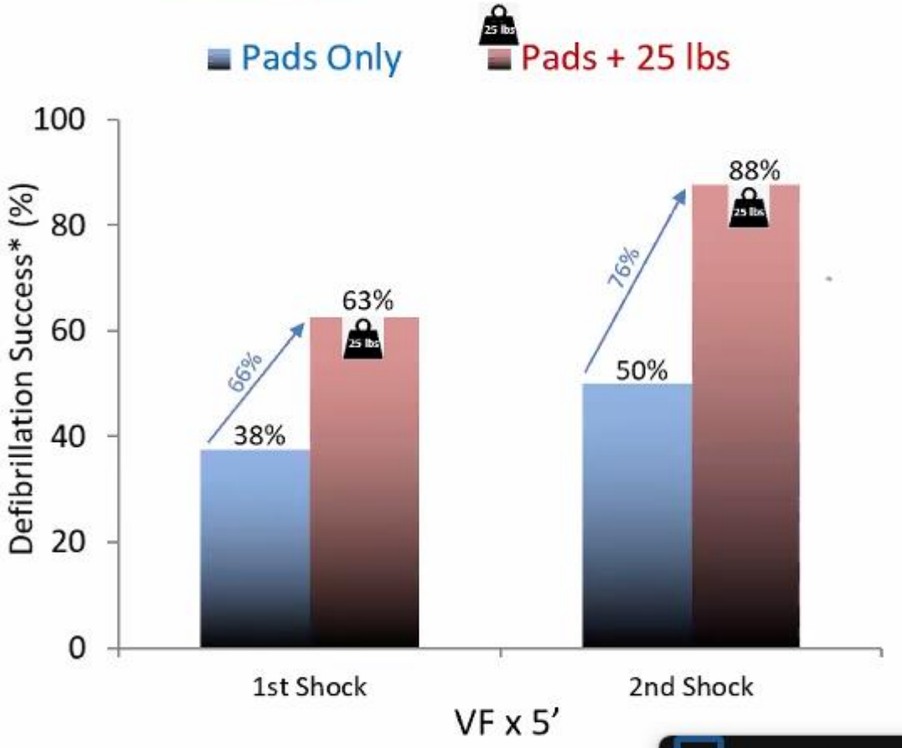
David E Persse, MD* Roger Dzwonczyk, PE‡ Charles G Brown, MD*

n = 32 swine (36.5-55.7kg)

VF

Shock x 3 via self-adhesive pads

Shock x 3 via self-adhesive pads + 25 lbs pressure



Perssee DE. Ann Emerg Med 1999;34:129-33; Deakin CD et al. Am J Cardiol 2002;90:812-13

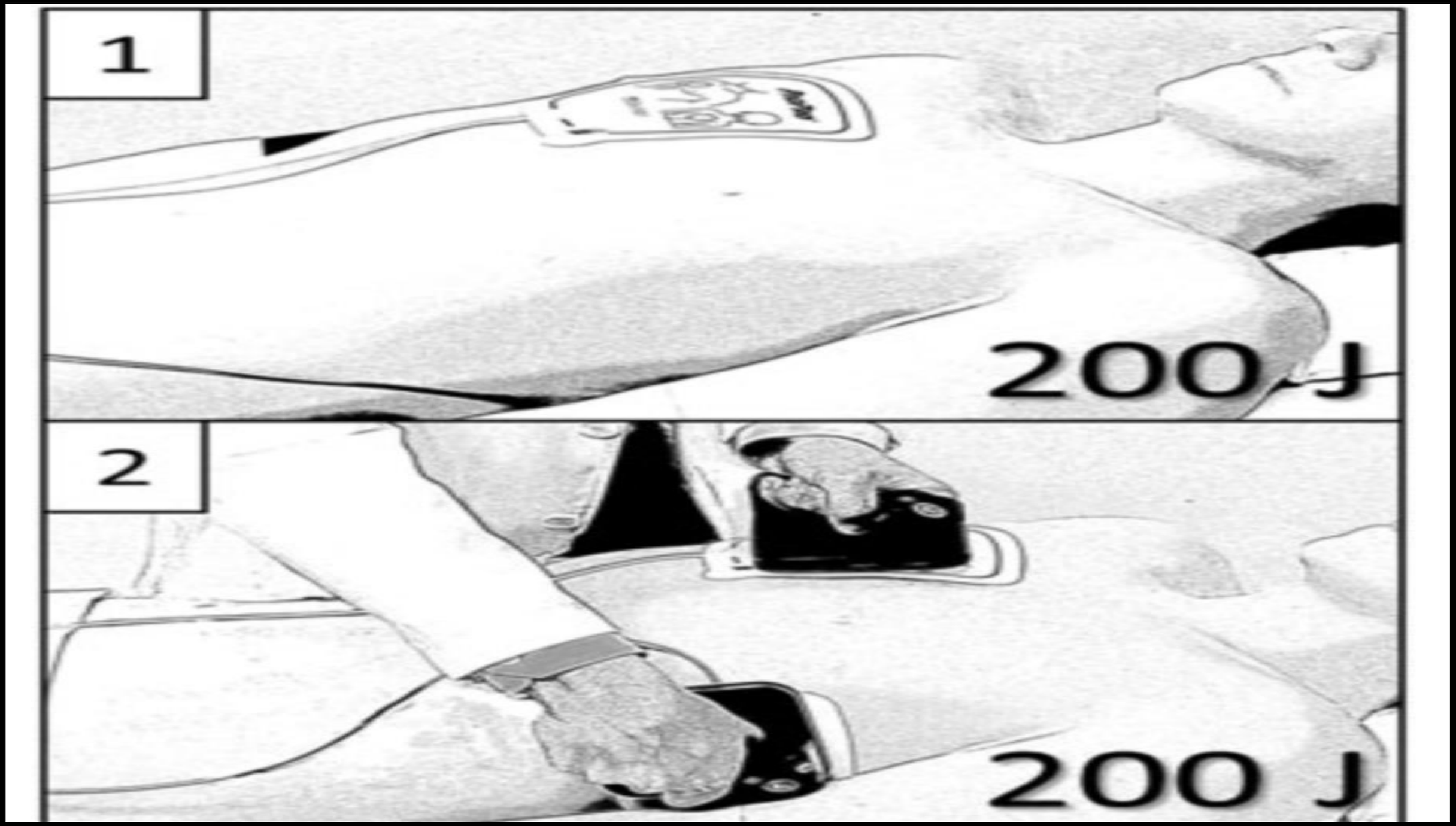
RESUSCITATION

EUROPEAN RESUSCITATION COUNCIL

LETTER TO THE EDITOR | ARTICLES IN PRESS

First Time Use of Manual Pressure Augmentation for Ventricular Fibrillation Arrest in the Community

Aleksandr Voskoboinik • Ziad Nehme • Peter M Kistler • Dion Stub • Karen Smith


1
200 J
2
200 J

Ambulance Victoria

Membership | Paramedics | Community | News & Media

Research

- In 2022, Ambulance Victoria will **randomize** cardiac arrest patients to receive a novel defibrillation intervention
- Paramedics will use gloved hands to put **downward pressure on defibrillation electrodes** during shock to reduce transthoracic impedance & increase delivery of current to the heart
- The trial will help determine whether such pressure can help restore a perfusing rhythm and improve survival in patients with cardiac arrest

Manual Pressure Augmentation

MONASH University

MEDICINE, NURSING AND HEALTH SCIENCES

AUGMENT – Manual Pressure Augmentation in Defibrillation of Ventricular Arrhythmias

A cluster randomised trial involving 1,500 participants, comparing the efficacy and safety of manual pressure augmentation (MPA) compared with standard defibrillation in out-of-hospital cardiac arrests (OHCA).

Chief Investigators

Prof Dion Stub, Dr Ziad Nehme, Prof Karen Smith, A/Prof Aleksandr Voskoboinik

Funding source

Heart Foundation Vanguard Grant

Estimated completion date

December 2024

Background

Standard defibrillation during an OHCA involves the defibrillator operator standing back and isolating the patient whilst shocks are delivered. MPA involves an operator wearing gloves pushing down on the sternal and apical patches at the time of energy delivery using either a clenched fist or open palm.

First defibrillation success rates using standard defibrillation techniques for OHCA vary between 50% and 79%. Prior research led by Chief Investigator Voskoboinik has demonstrated that when cardioverting atrial fibrillation - a non-life-threatening arrhythmia - MPA on pads had superior outcomes compared to standard practice. This technique has never been robustly studied in the context of life-threatening OHCA, where it has the real potential to save lives.

Aim

To assess the efficacy and safety of defibrillation with MPA compared to standard defibrillation in OHCA.

Ambulance Victoria suspends trial after paramedic receives shock while restarting patient's heart

Marta Pascual Juanola

February 1, 2023 — 11.54am

Save | Share | A A A

KEY POINTS

- A paramedic was thrown across a room when she got an electric shock while using a defibrillator to restart a patient's heart.
- She was using the lifesaving device with a trial method known as manual pressure augmentation.
- Although it's believed the method improves patient outcomes and is usually safe, the incident has prompted Ambulance Victoria to halt the trial.

Ambulance Victoria has halted the trial of a new defibrillating technique after a paramedic received an electric shock that threw her across the room while trying to restart the heart of a patient in northern Victoria.

Victorian Ambulance Union secretary Danny Hill said the advanced life-support paramedic was trialling a method known as manual pressure augmentation on a cardiac arrest patient on Friday when she was zapped.

Paramedic shocked using new defibrillation technique being trialled in Victoria

01/02/2023

SHARE THIS ARTICLE

RUMOUR CONFIRMED | THE RUMOUR FILE

RUMOUR CONFIRMED

A Victorian paramedic has received an electric shock while defibrillating a patient.

The paramedic was using a technique being trialled in Victoria known as 'manual pressure augmentation' when the incident occurred on Friday.

Pharmacology

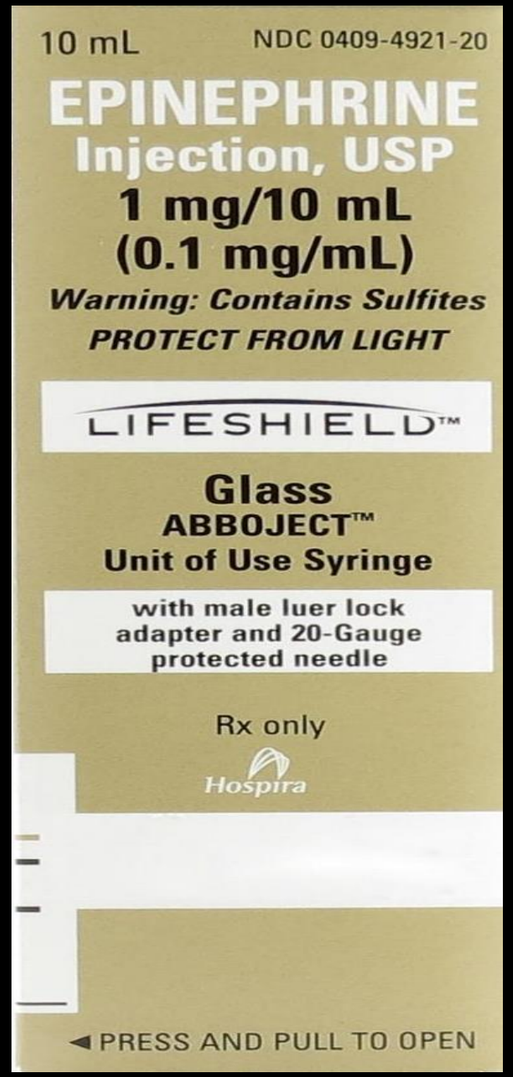
Epinephrine Origins

AN EXPERIMENTAL RESEARCH INTO THE RESUSCITATION OF DOGS KILLED BY ANESTHETICS AND ASPHYXIA.

By GEORGE CRILE, M.D., AND DAVID H. DOLLEY, M.D.

(*From the Laboratory of Surgical Physiology, Western Reserve Medical School, Cleveland.*)

PLATES XLII–XLIX.



Adrenaline made **no difference to survival**

Jacobs et al, 2011

Adrenaline was associated with a **worse survival** rate

Dumas et al, 2014

Adrenaline was associated with a **better survival** rate in a subgroup with a non-shockable heart rhythm

Nakahara et al, 2013

Adrenaline made **no difference to survival** or to the risk of severe brain damage

Machida et al, 2012

Adrenaline was associated with a **worse survival** rate

Herlitz et al, 1995

Adrenaline was associated with a **worse survival** rate and increased risk of **severe brain damage**

Olasveengen et al, 2012

Adrenaline made **no difference to survival**

Woodhouse et al, 1995

Adrenaline was associated with a **worse survival** rate

Holmberg et al, 2002

Adrenaline was associated with a **worse survival** rate and increased risk of **severe brain damage**

Hagihara et al, 2012

Adrenaline made **no difference to survival**

Ong et al, 2007

Adrenaline made **no difference to survival**, but increased the risk of **severe brain damage**

Hayashi et al, 2012

PARAMEDIC2 Trial

Higher survival w Epi

BUT

No difference in good neuro outcome

PARAMEDIC2

Survival = 3.2% in the adrenaline group vs 2.4% in the placebo group (OR 1.39, 95% CI 1.06-1.82; P=0.02)

Favourable neurological outcomes = 2.2% adrenaline vs 1.9% placebo (OR 1.18, 95% CI 0.86-1.61)

Severe neurological impairment (in survivors) = 31% adrenaline group vs 17.8% placebo

TheResusRoom.co.uk


EPINEPHRINE
IS THE MIND KILLER
EMS AVENGER
10 mL
NDC 0409-4921-20
EPINEPHRINE
Injection, USP
1 mg/10 mL
(0.1 mg/mL)
Warning: Contains Sulfites
PROTECT FROM LIGHT
LIFESHIELD
Glass
ABBOJECT
Unit of Use Syringe
with male luer lock
adapter and 25-Gauge
Protected needle
Rx only
RESUSCITATION

Risks of Epinephrine

- Increases myocardial work,
- Increases risk of tachydysrhythmia,
- Promotes thrombogenesis and platelet activation
- Reduces microvascular perfusion including the CNS
  - (JEM, 2017;52:809).

Risks of Epinephrine

- Epinephrine as potential risk factor for prehospital re-arrest
  - Yamashita, et al, Prehospital Emergency Care, February 2020
  - Requirement for epi before prehospital ROSC was associated with
    - Subsequent re-arrest
    - Poorer neuro outcome

Current Epi Dosing VF – 2020

- 1mg IV/IO every 3-5 minutes
  - Think of the puppies

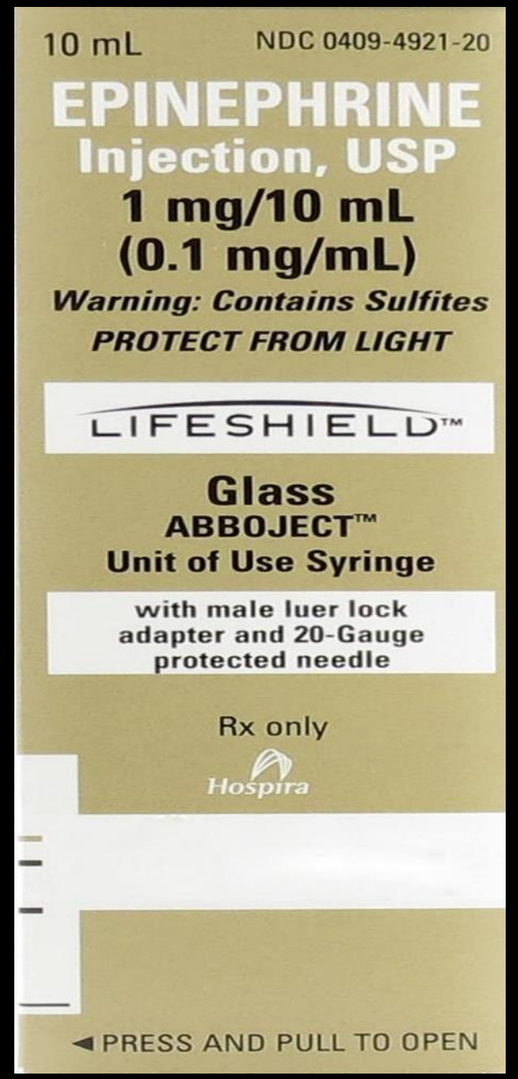
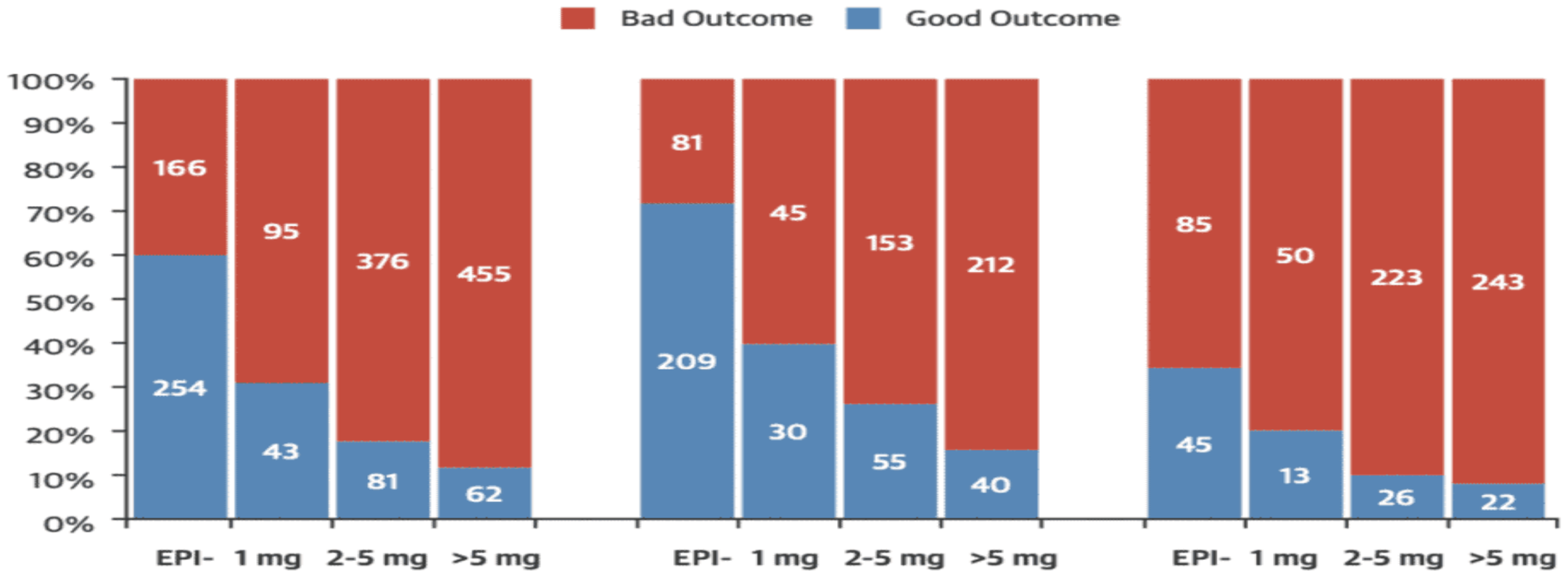


FIGURE 3 **Association Between Outcome and Early Dose of EPI and According to the Initial Rhythm**



	Overall			Shockable			Non-Shockable		
	Odds Ratio	[95%CI]	p-value	Odds Ratio	[95%CI]	p-value	Odds Ratio	[95%CI]	p-value
EPI-	1			1			1		
1 mg	0.48	[0.27-0.84]	0.01	0.38	[0.18-0.78]	0.008	0.60	[0.23-1.60]	0.31
2-5 mg	0.30	[0.20-0.47]	<0.001	0.25	[0.14-0.44]	<0.001	0.40	[0.19-0.84]	0.02
>5 mg	0.23	[0.14-0.37]	<0.001	0.16	[0.08-0.30]	<0.001	0.36	[0.16-0.82]	0.01

PARAMEDIC 3

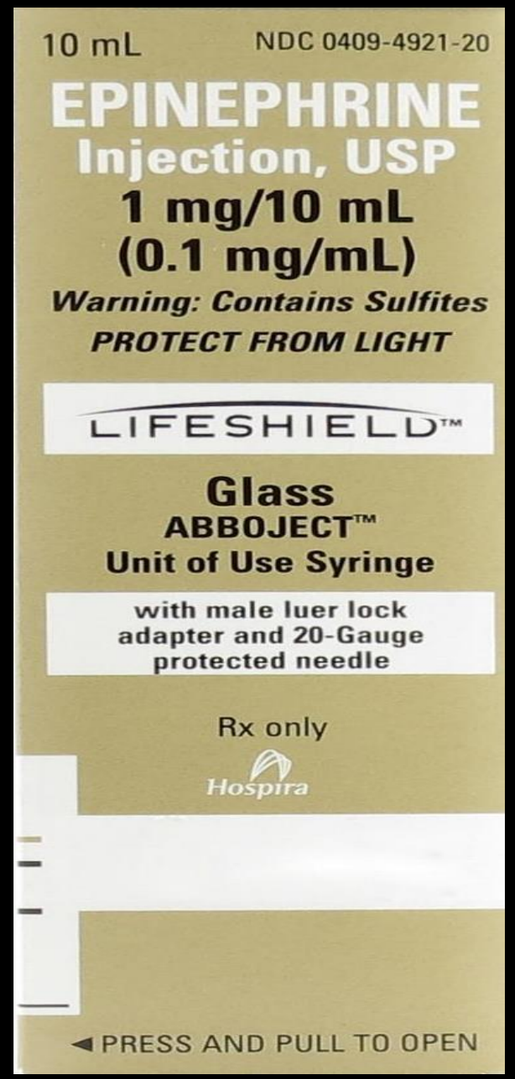
Medication Route in Cardiac Arrest

PARAMEDIC3

- **P**rehospit**A**l **RA**ndomized trial of **MEDIC**ation route in out-of-hospital cardiac arrest (**PARAMEDIC3**)
  - **15,000 out-of-hospital cardiac arrests**
  - **30 day survival**
  - **April 1, 2021 – March 31, 2025**

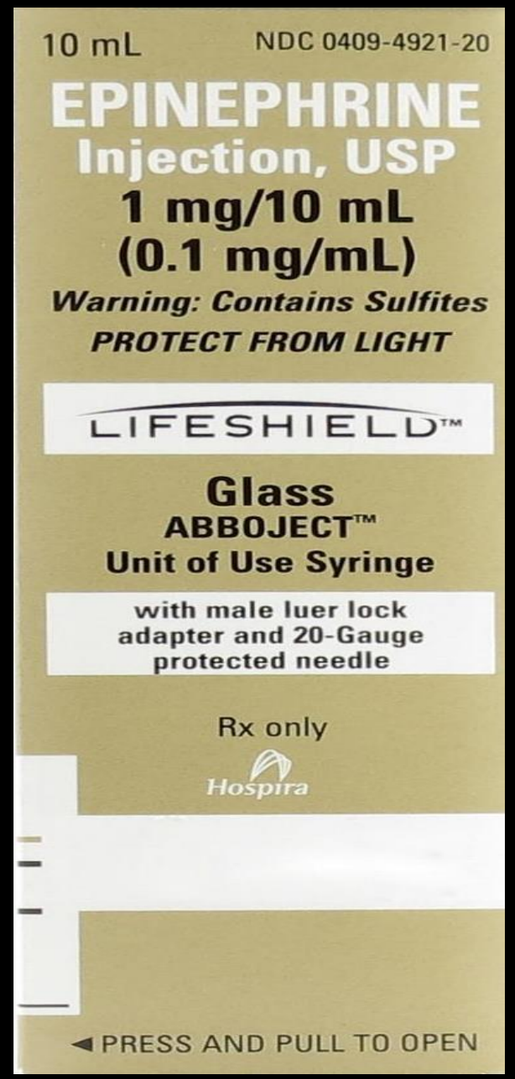
San Antonio Epi Dosing - Miramontes

- 0.5 mg IV q 5-10 minutes
- VF = 2 Doses
- Non-VF = 4 doses
- “No ACLS Card”



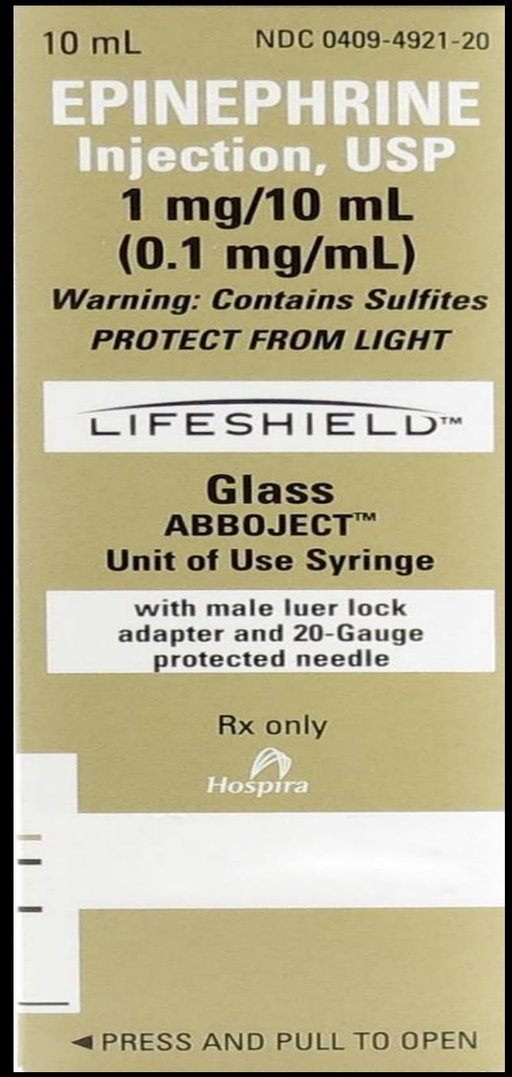
Broward Epi Dosing

- VF - 1 mg IV then Epi Drip
- Amiodarone
- If PMVT – MgSO4



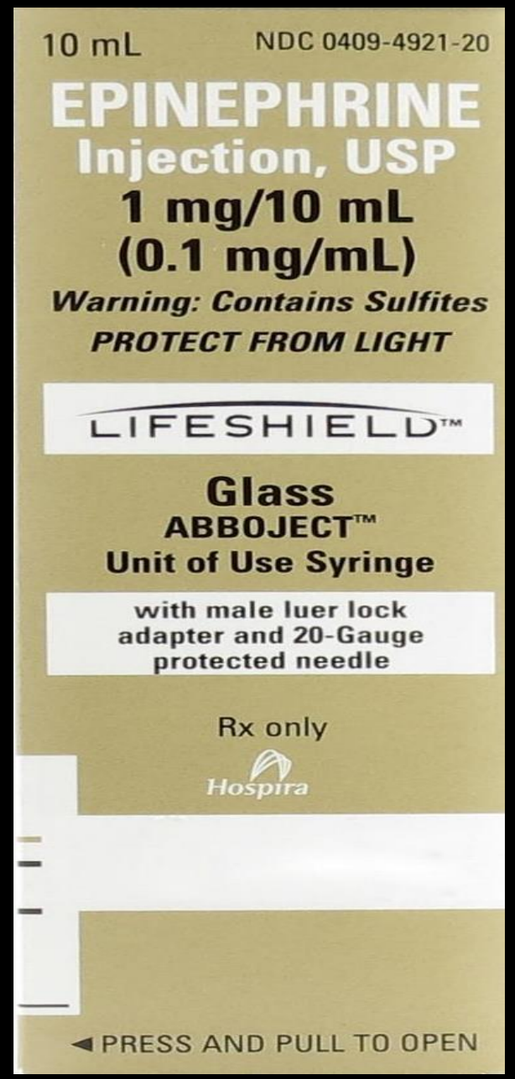
Antevy Epi Dosing

- **VF – NO Epi!**



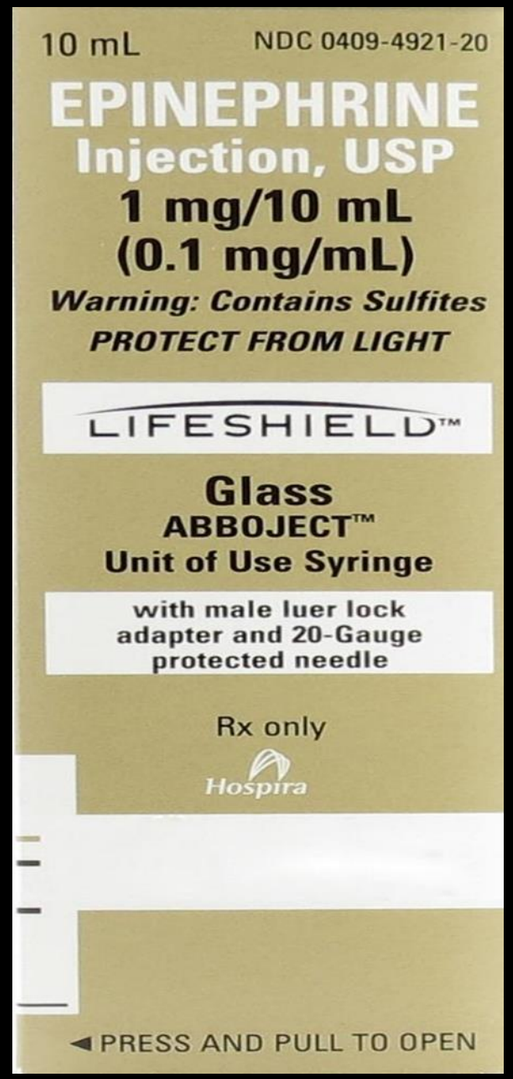
ACR Epi Dosing

- **No Epi Until:**
  - **HQCPR / Mechanical CPR**
  - **ITD (Res-Q-Pod)**
  - **Apneic O2 during ETT or SGA**
  - **EtCO2 at least 20mmHg before defib/epi**



Epi Conclusions??

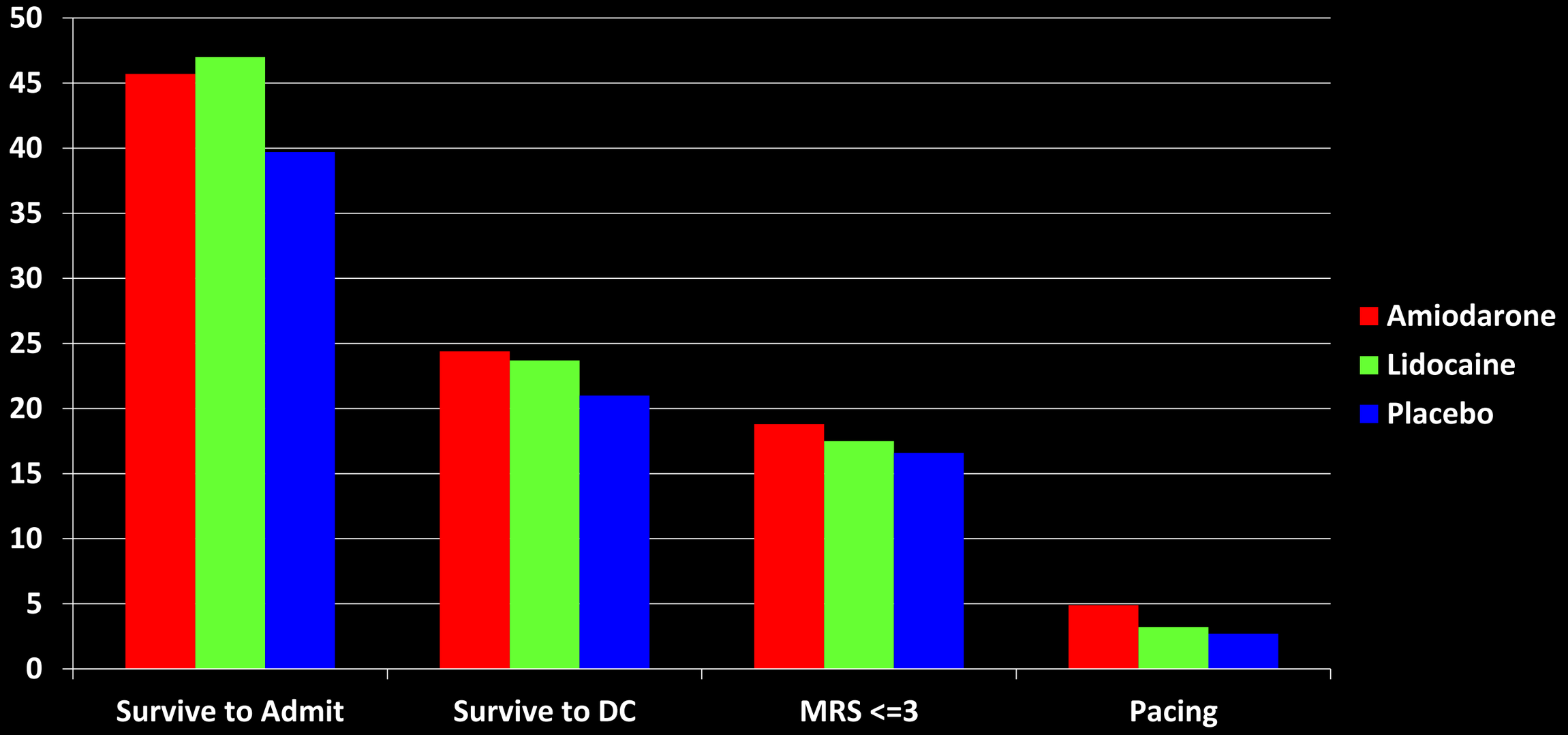
- ↑ROSC but bad neuro
- Higher doses do not help
- Timing may be important
- We want it to work but……



Amiodarone, Lidocaine, Placebo Study (ALPS)

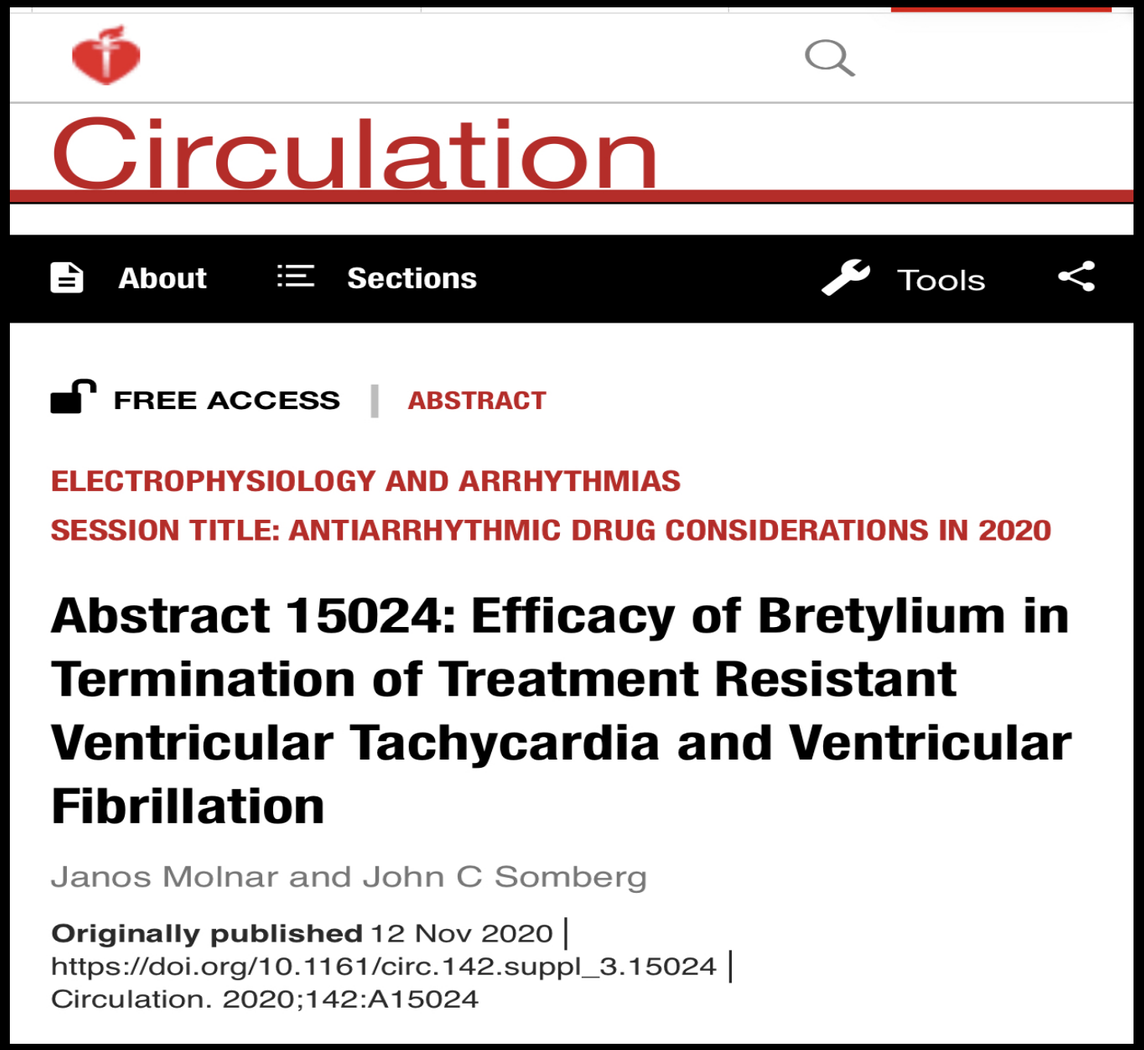
Kudenchuk, PJ, et al (2016).
Amiodarone, Lidocaine, or Placebo in Out-Of-Hospital Cardiac Arrest.
New England Journal of Medicine
2016 375(8), 802-803

ALPS Outcomes



NO ANTIARRHYTHMIC DRUG has yet been shown to INCREASE SURVIVAL or NEUROLOGIC OUTCOMES after cardiac arrest due to VF/pVT

What Was Old Is New Again



Circulation

About Sections Tools

FREE ACCESS | ABSTRACT

ELECTROPHYSIOLOGY AND ARRHYTHMIAS

SESSION TITLE: ANTIARRHYTHMIC DRUG CONSIDERATIONS IN 2020

Abstract 15024: Efficacy of Bretylium in Termination of Treatment Resistant Ventricular Tachycardia and Ventricular Fibrillation

Janos Molnar and John C Somberg

Originally published 12 Nov 2020 |
https://doi.org/10.1161/circ.142.suppl_3.15024 |
Circulation. 2020;142:A15024

bretylium

Adult Indications & Dosing

Dosage Forms: INJ

DEA/FDA
Rx

No Black Box Warning

ventricular arrhythmias, malignant

initial tx

Dose: 5–10 mg/kg/dose IV q15–30min prn; Start: 5 mg/kg/dose IV x1; Max: 30 mg/kg total dose; Info: for short-term tx; not 1st-line agent

Calculate Dose

maintenance tx

Dose: 1–2 mg/min IV; Alt: 5–10 mg/kg/dose IV q6h; Info: for short-term tx; not 1st-line agent

Calculate Dose

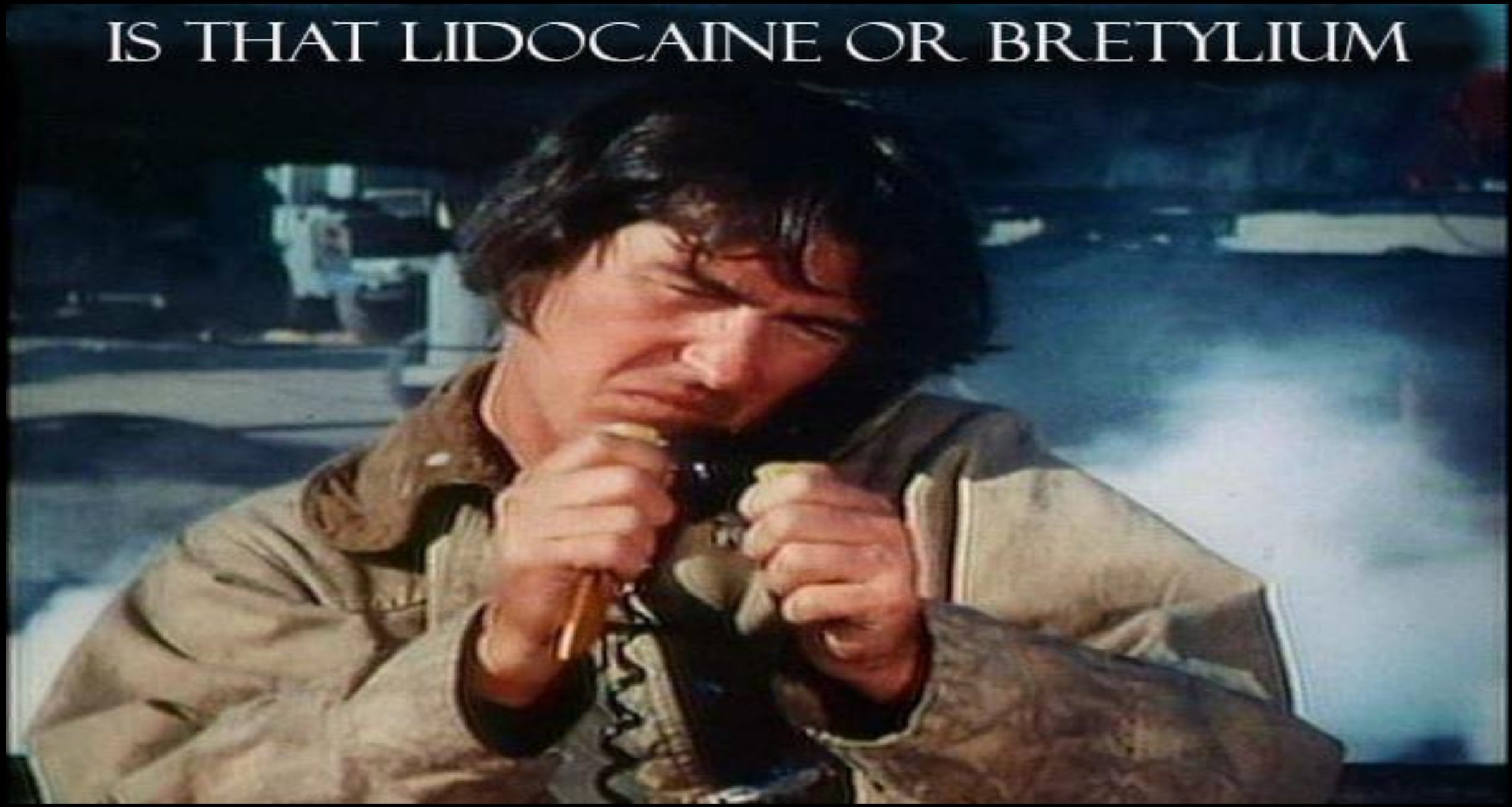
ventricular arrhythmias, other

initial tx

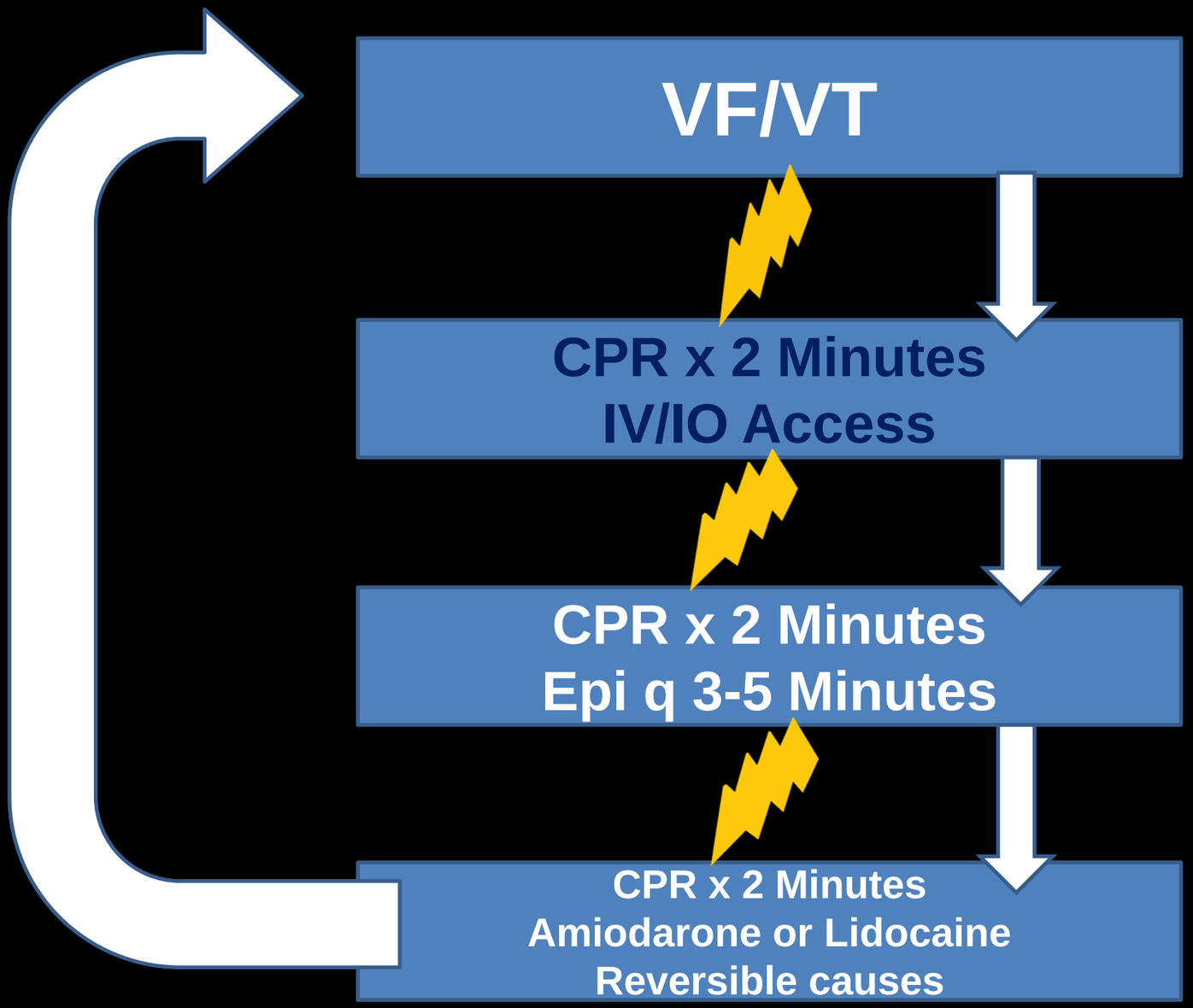
Dose: 5–10 mg/kg/dose IM/IV q1–2h prn; Info: for short-term tx; not 1st-line agent

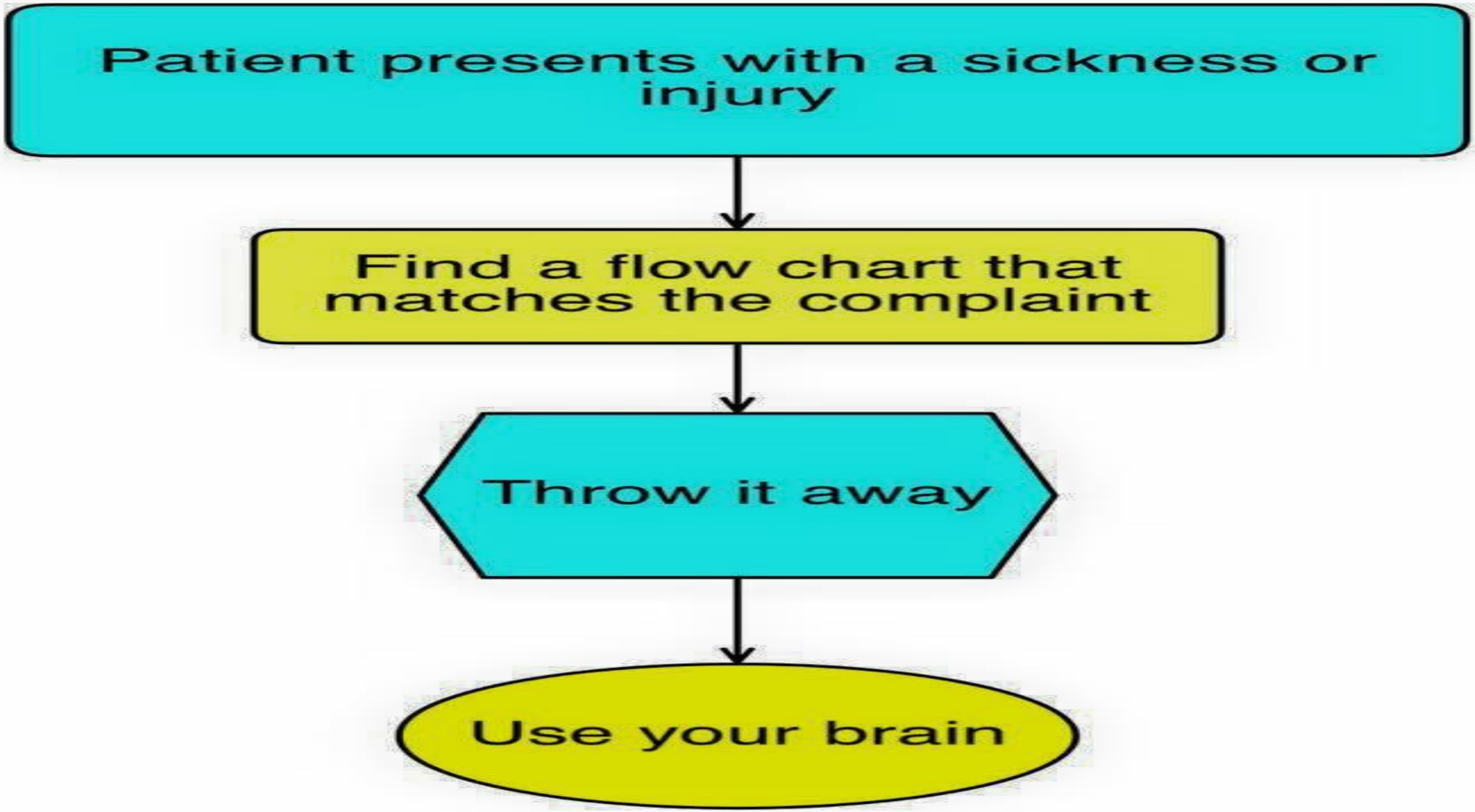
Calculate Dose

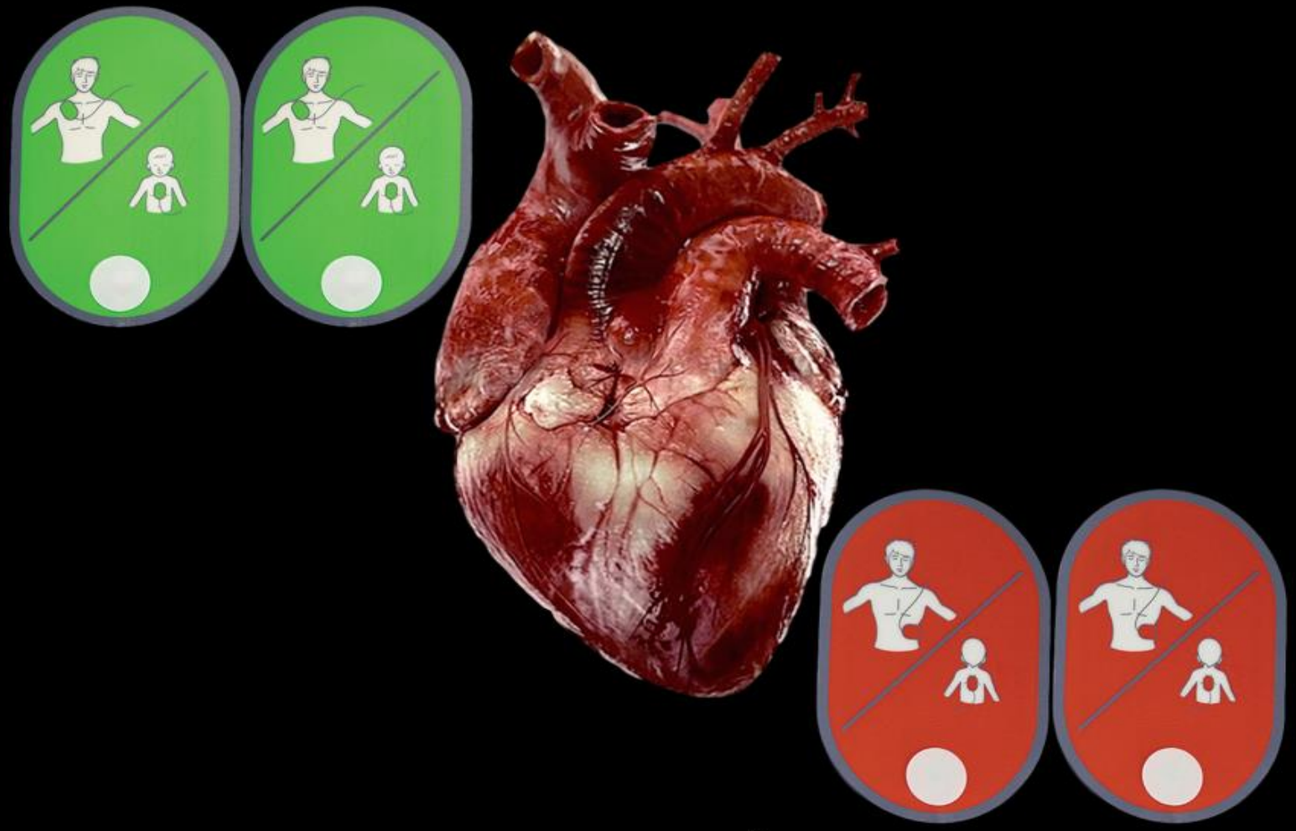
Formulary No Formulary Selected


IS THAT LIDOCAINE OR BRETYLIUM

ACLS for VF/VT

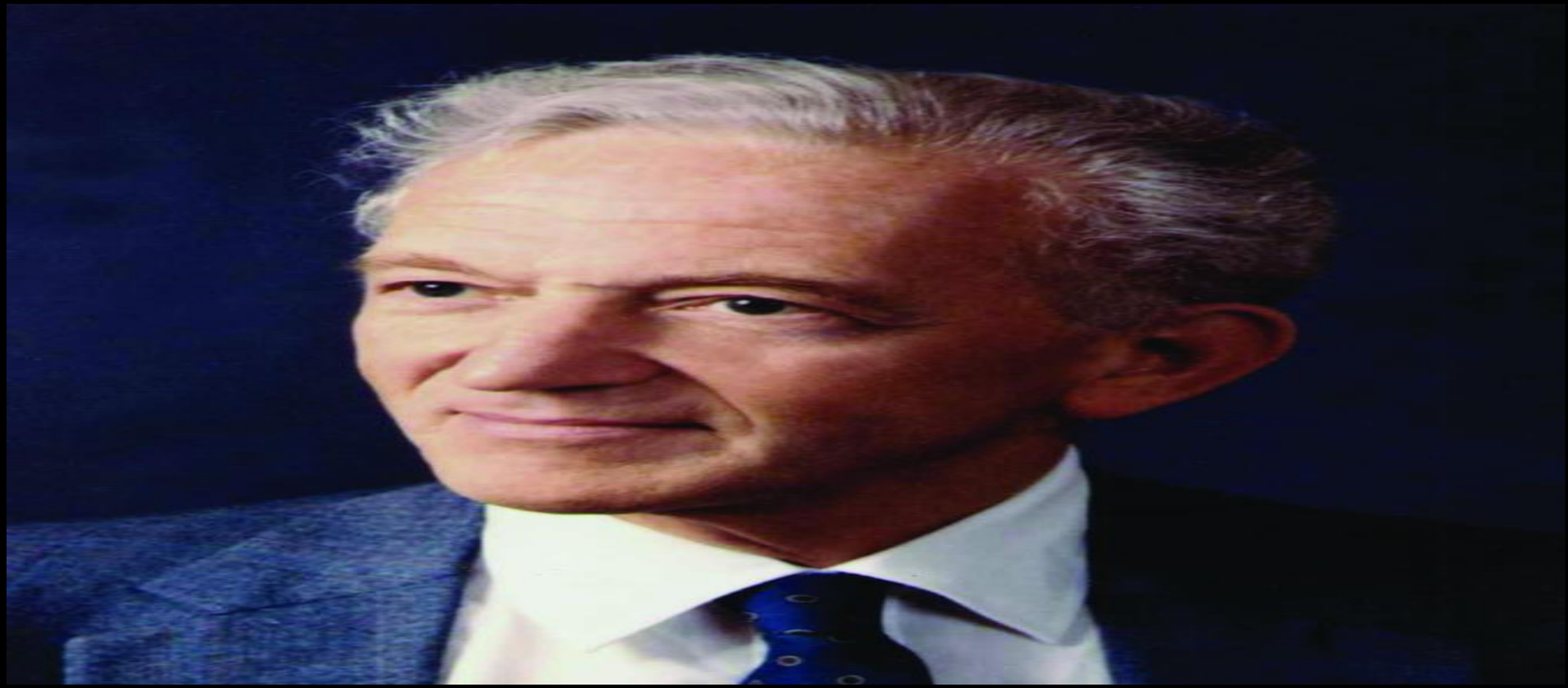



Patient presents with a sickness or injury
Find a flow chart that matches the complaint
Throw it away
Use your brain



Dual Sequential Defibrillation (DSD)

Esmolol

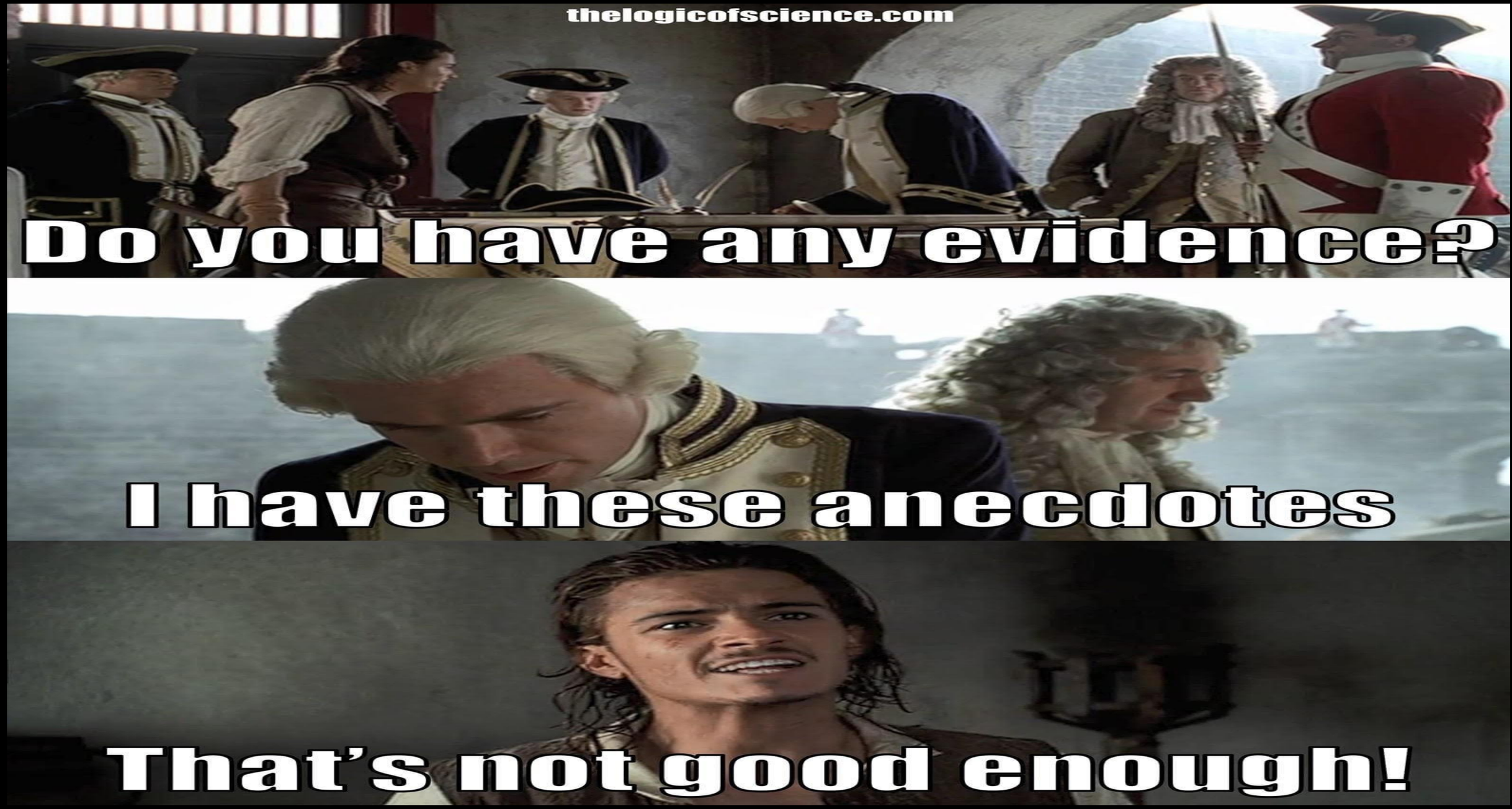


“for the person with a heart and brain too good to die.” - Dr. Peter Safar

1986	Chang	Canine	Both healthy and induced infarcted canine hearts with induced VF DSD shock terminated if single shock did not
1986	Jones	Human	21 ***volunteers*** with WPW underwent induced VF in EP lab to single or double sequential defibrillation DSD had lower defibrillation threshold, patients with repeated failed single shocks at max voltage had immediate successful DSD as "rescue"
1989	Brady	Human	16 - OOHCA survivors were randomized and demonstrated lower defibrillation threshold with DSD
1994	Hoch	2,990 EP lab	5 patients with rVF resistant to single shocks. All 5 VF terminated with first DSD shock All 5 survived

2014	Cabanas	OOHCA 10 patients	Successful conversion to NSR in 7/10 patients Unfortunately no survivors
2014	Gerstein	DSD IHCA	Successful DSD defibrillation after 74 minutes of resuscitation
2015	Lybeck	40 yo OHCA with VF from commotio cordis	DSD on 8th attempt CT cardiac contusion. Normal coronaries on cath. DC with full neurological function
2016	Bowman	21 yo SAD	DSD on 8th defibrillation attempt Conversion to SR Cath -> normal coronaries DC with CPC 1, back to college, AICD

2016	Johnston	28 yo OHCA	CPR 6 single shocks 1 DSD w ROSC Dx w LQT, AICD, CPC 2
2016	Ross	3 Years 3470 OHCA	279 complete data with rVF 50 DSD, 229 No DSD No significant survival difference
2016	Cortez	4 Years 2428 OHCA	12 DSD 9 converted out of VF 3 ROSC - 2 w CPC 1
2016	Jui	Prospective Study	28 patients 12 w conversion from VF 9 w ROSC 3 survivors w CPC 1-2 (ages 27-81)


thelogicofscience.com
Do you have any evidence?
I have these anecdotes
That's not good enough!

DOSE VF Study (Pilot Study) 2020

- DOuble Sequential External Defibrillation for Refractory Ventricular Fibrillation
  - Cheskes, et al, Resuscitation, 2020

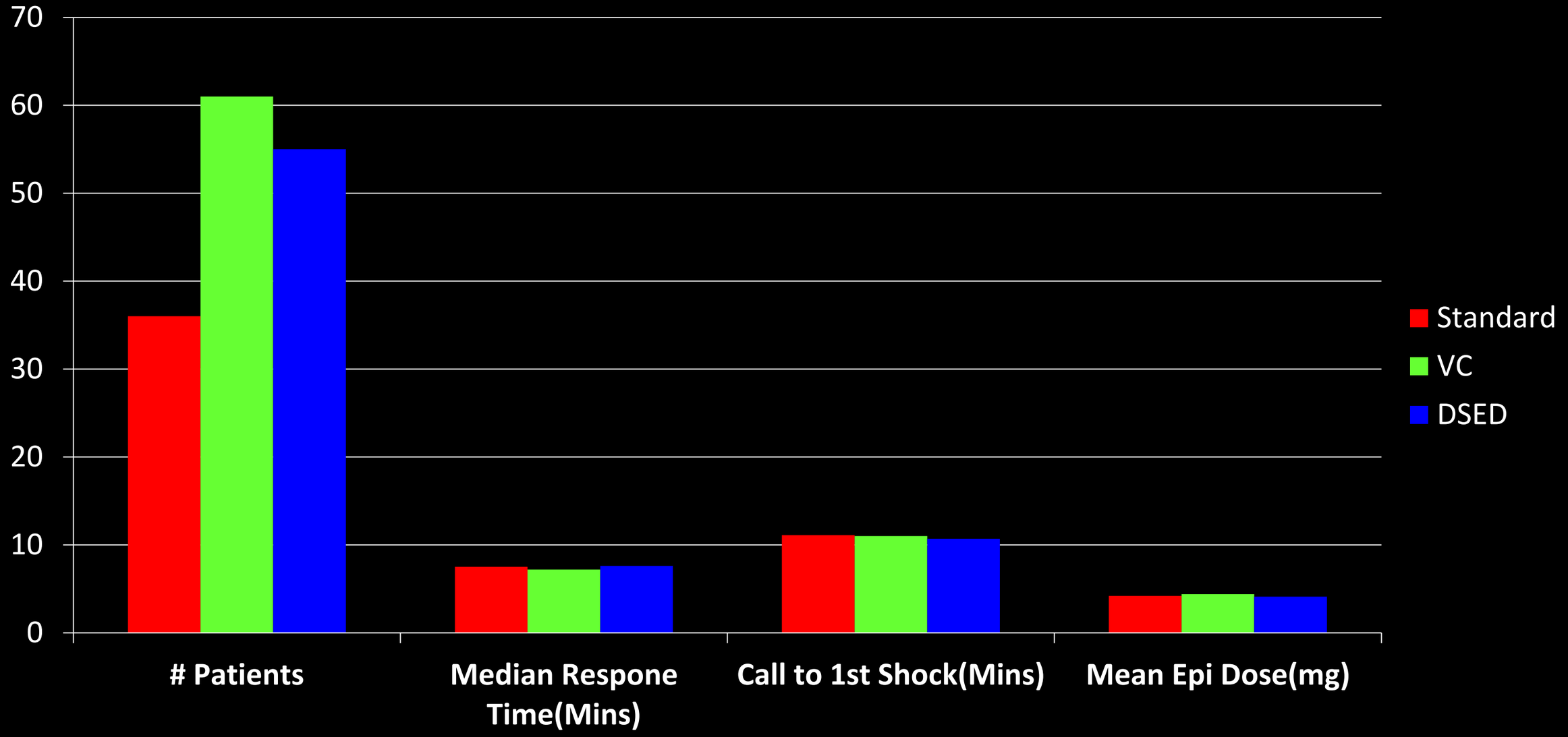
What They Did

- ***Strategy 1:*** **Continued standard defibrillation pads in the anterior-lateral configuration**

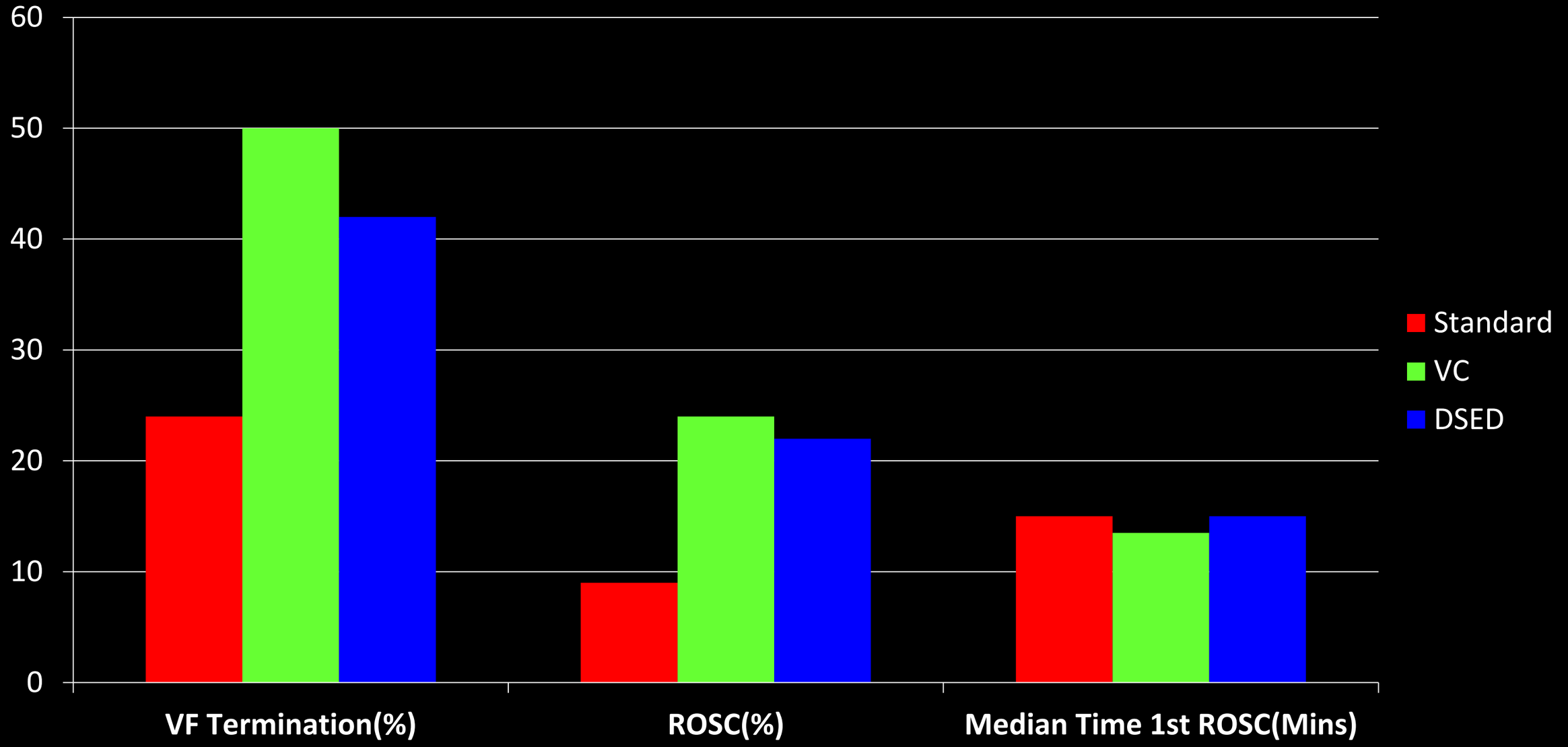
- ***Strategy 2:*** **Vector change (VC) defibrillation with pads transferred from anterior-lateral to anterior-posterior position**

- ***Strategy 3:*** **DSED with intentional delay to ensure rapid sequence delivery**

DOSE-VF Pilot



DOSE-VF Pilot



Important Finding

- **There were *no reported cases of defibrillator malfunction*, skin burns, difficulty with pad placement or concerns expressed by paramedics, families or emergency department staff about the trial.**

Conclusions

- **Findings suggest the DOSE-VF protocol is feasible and safe.**

- **Rates of VFT and ROSC were higher in the VC and DSED than standard defibrillation.**

DOSE-VF Follow-Up 2022

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

FREE PREVIEW

Defibrillation Strategies for Refractory Ventricular Fibrillation

Sheldon Cheskes, M.D., P. Richard Verbeek, M.D., Ian R. Drennan, A.C.P., Ph.D., Shelley L. McLeod, Ph.D., et al.

November 6, 2022
DOI: 10.1056/NEJMoa2207304

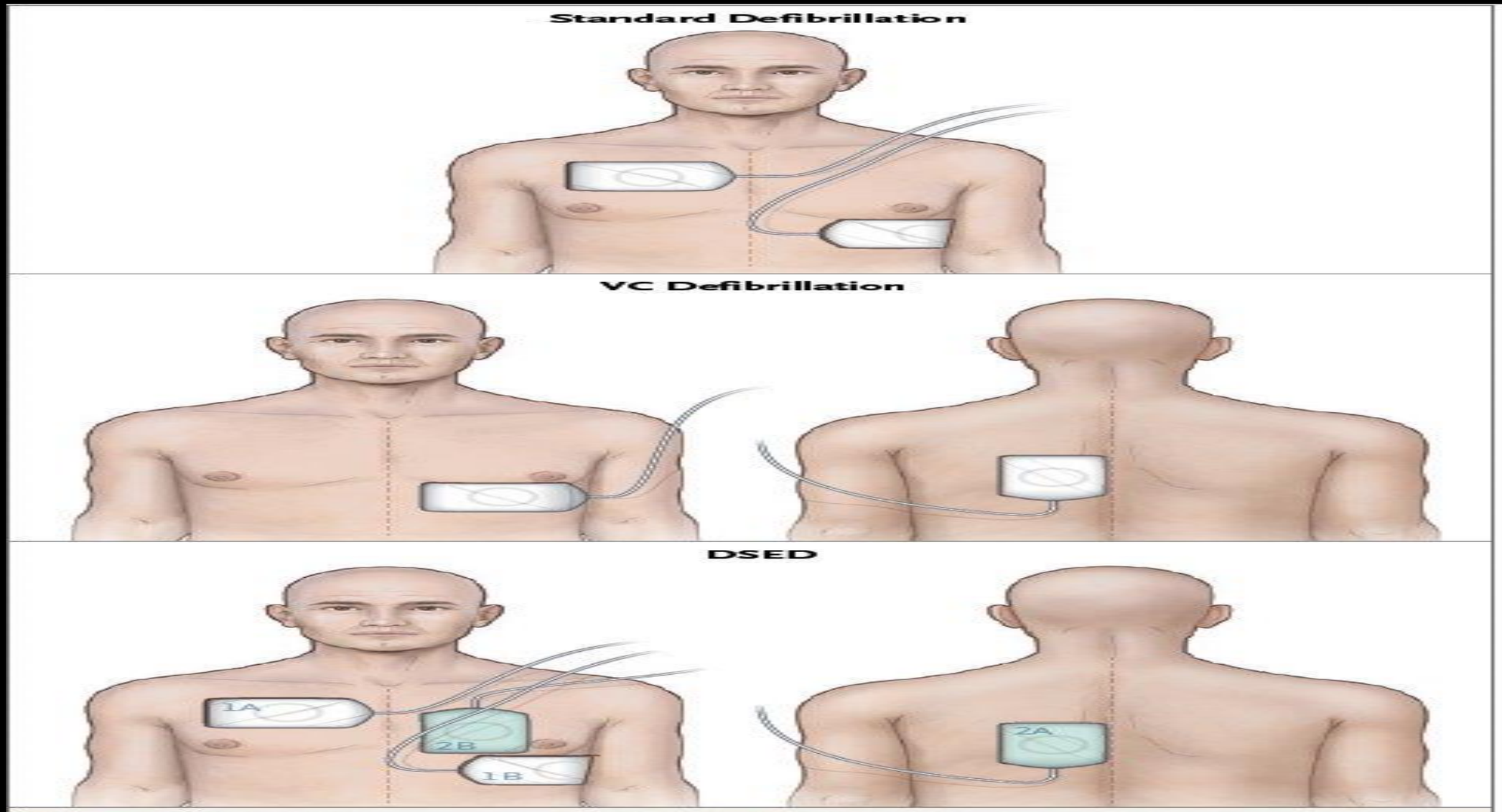
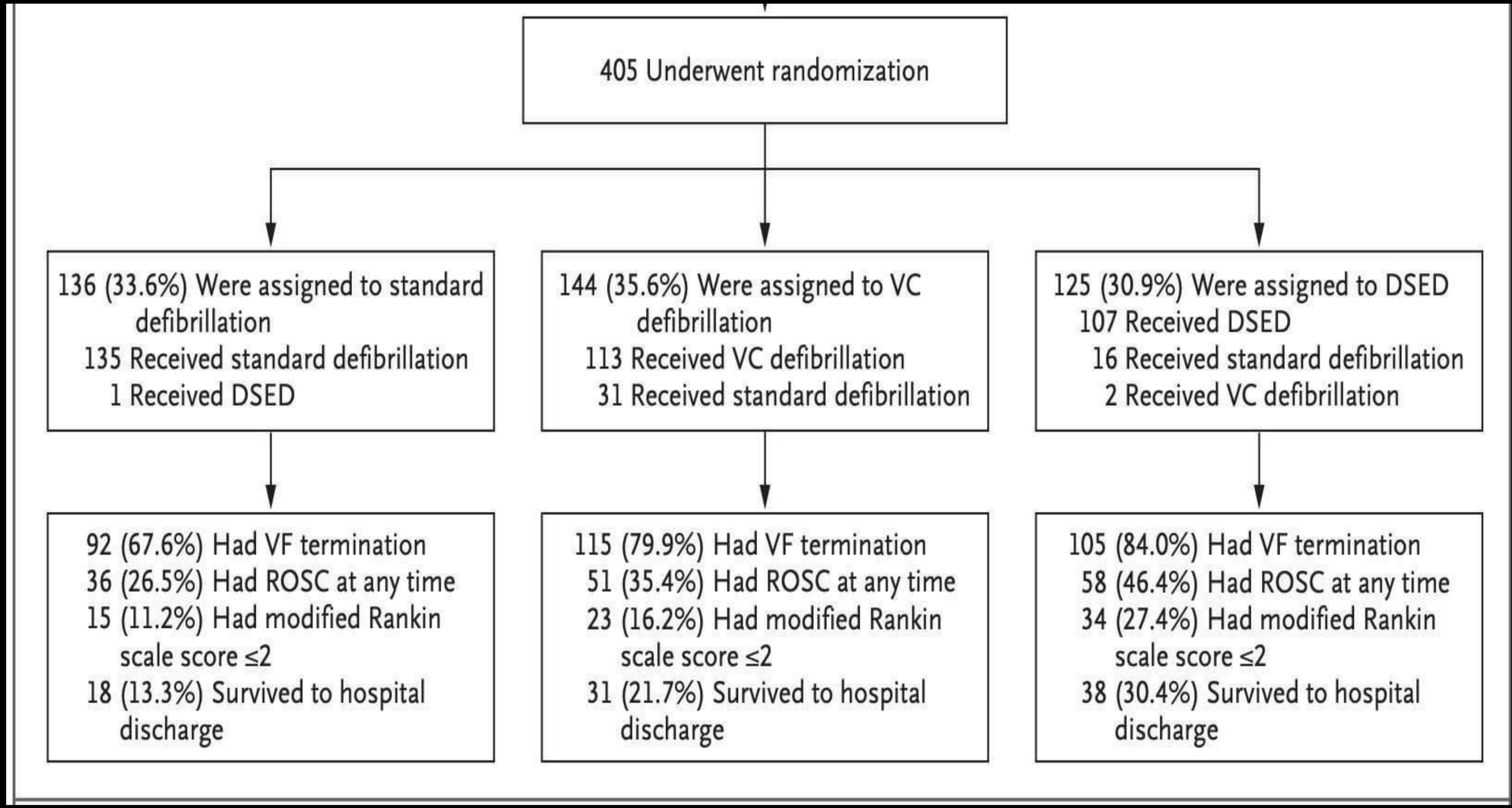
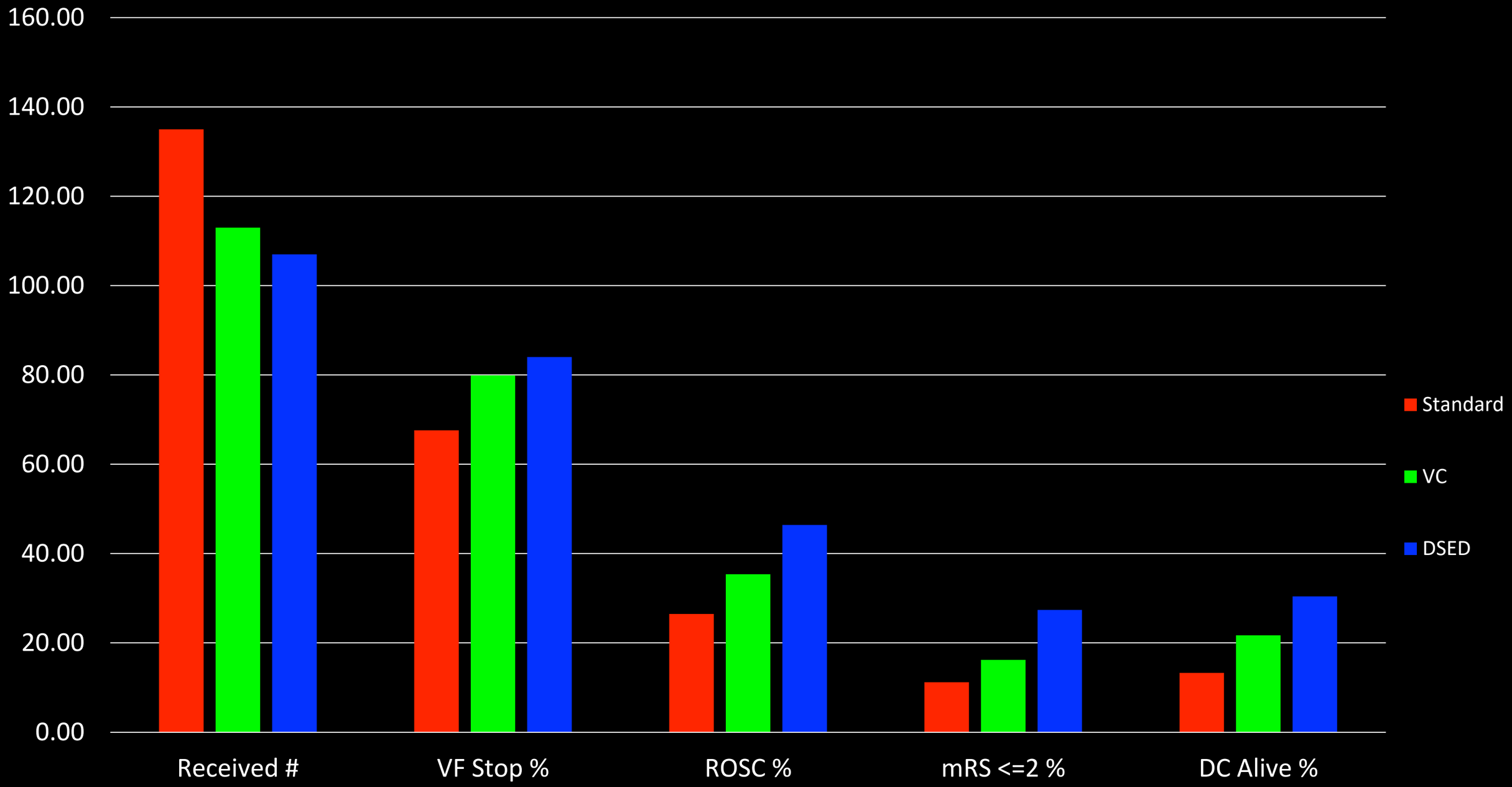
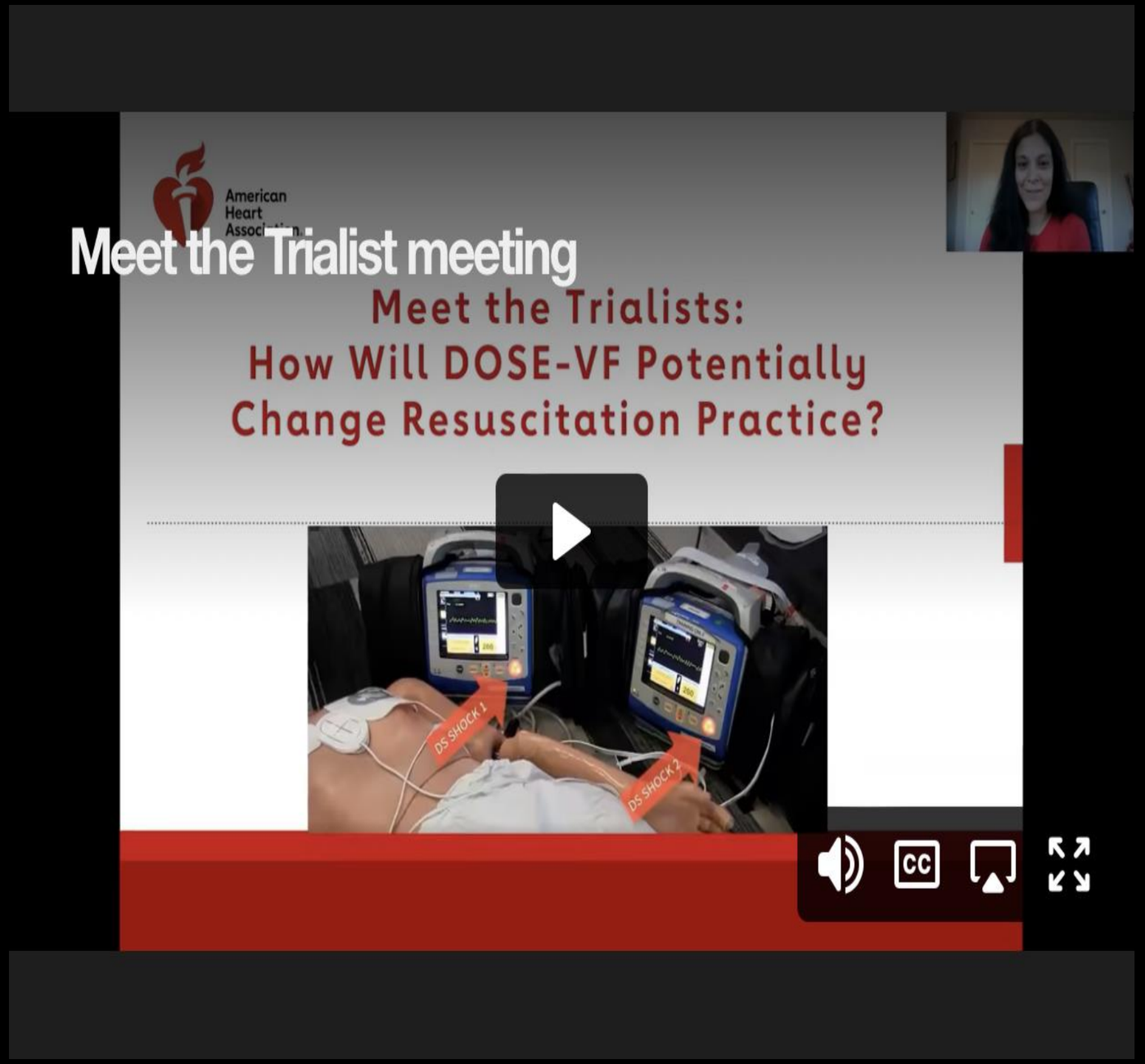
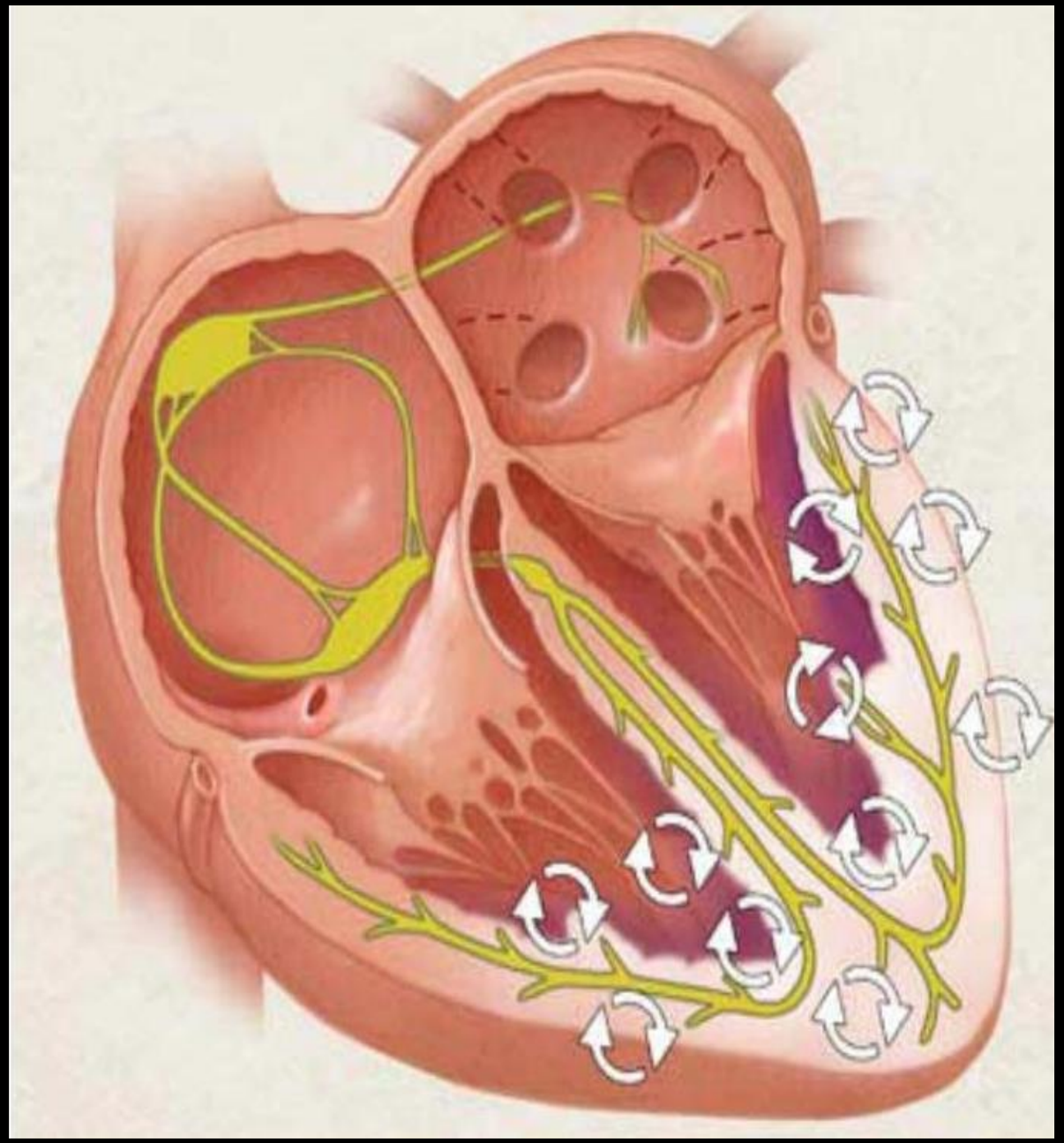


Figure 1. Pad Placement in the Three Defibrillation Strategies.
Pad placement for standard defibrillation, vector-change (VC) defibrillation, and double sequential external defibrillation (DSED) is shown. In the bottom panel, defibrillation pads 2A and 2B are those of the second defibrillator, with the pads placed in the posterior and anterior positions. For all strategies, the first three shocks occurred with pads placed in the configuration used for standard defibrillation.


405 Underwent randomization
136 (33.6%) Were assigned to standard defibrillation
135 Received standard defibrillation
1 Received DSED
144 (35.6%) Were assigned to VC defibrillation
113 Received VC defibrillation
31 Received standard defibrillation
125 (30.9%) Were assigned to DSED
107 Received DSED
16 Received standard defibrillation
2 Received VC defibrillation
92 (67.6%) Had VF termination
36 (26.5%) Had ROSC at any time
15 (11.2%) Had modified Rankin scale score ≤2
18 (13.3%) Survived to hospital discharge
115 (79.9%) Had VF termination
51 (35.4%) Had ROSC at any time
23 (16.2%) Had modified Rankin scale score ≤2
31 (21.7%) Survived to hospital discharge
105 (84.0%) Had VF termination
58 (46.4%) Had ROSC at any time
34 (27.4%) Had modified Rankin scale score ≤2
38 (30.4%) Survived to hospital discharge


160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
Received #
VF Stop %
ROSC %
mRS <=2 %
DC Alive %
Standard
VC
DSED


American Heart Association
Meet the Trialist meeting
Meet the Trialists:
How Will DOSE-VF Potentially
Change Resuscitation Practice?
DS SHOCK 1
DS SHOCK 2
CC



- Larger current density
- Broader energy vector
- Even distribution over myocardium
- Prolonged shock duration
- More myocytes depolarized
- Reduced defibrillation threshold from 1st shock to 2nd shock
- More energy

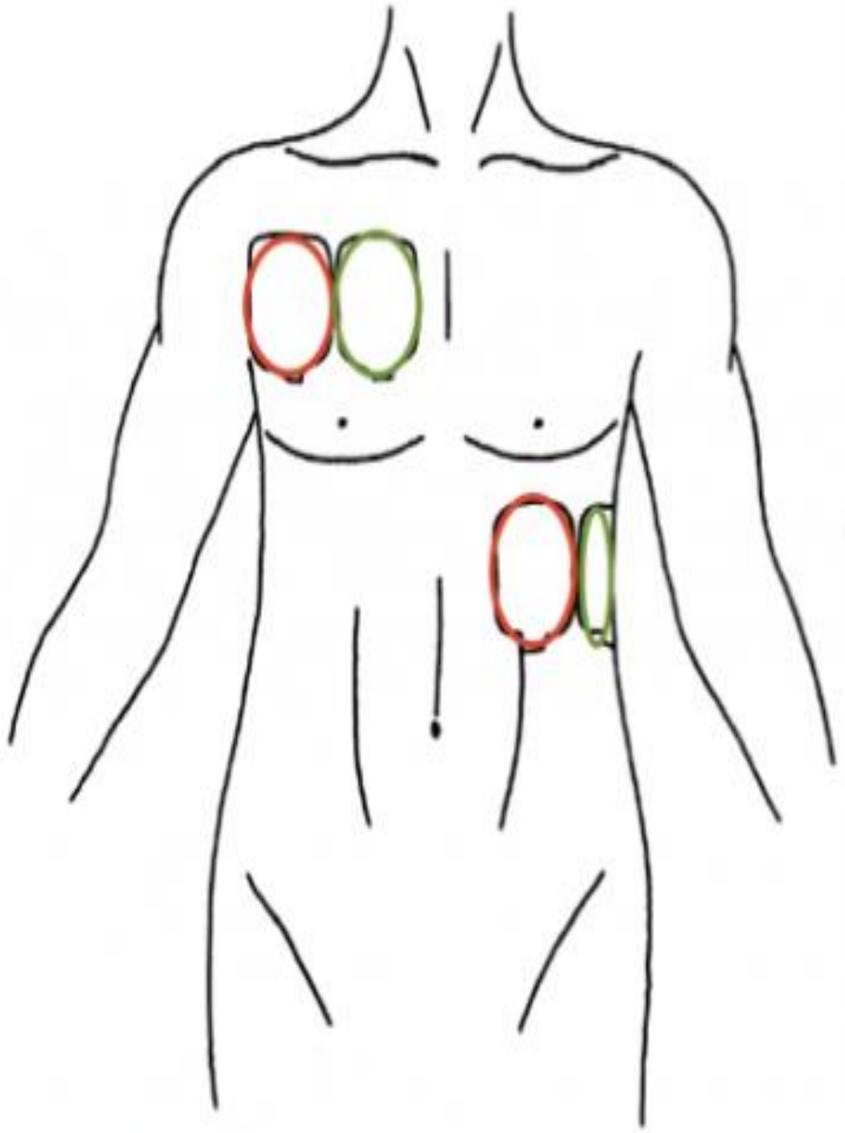
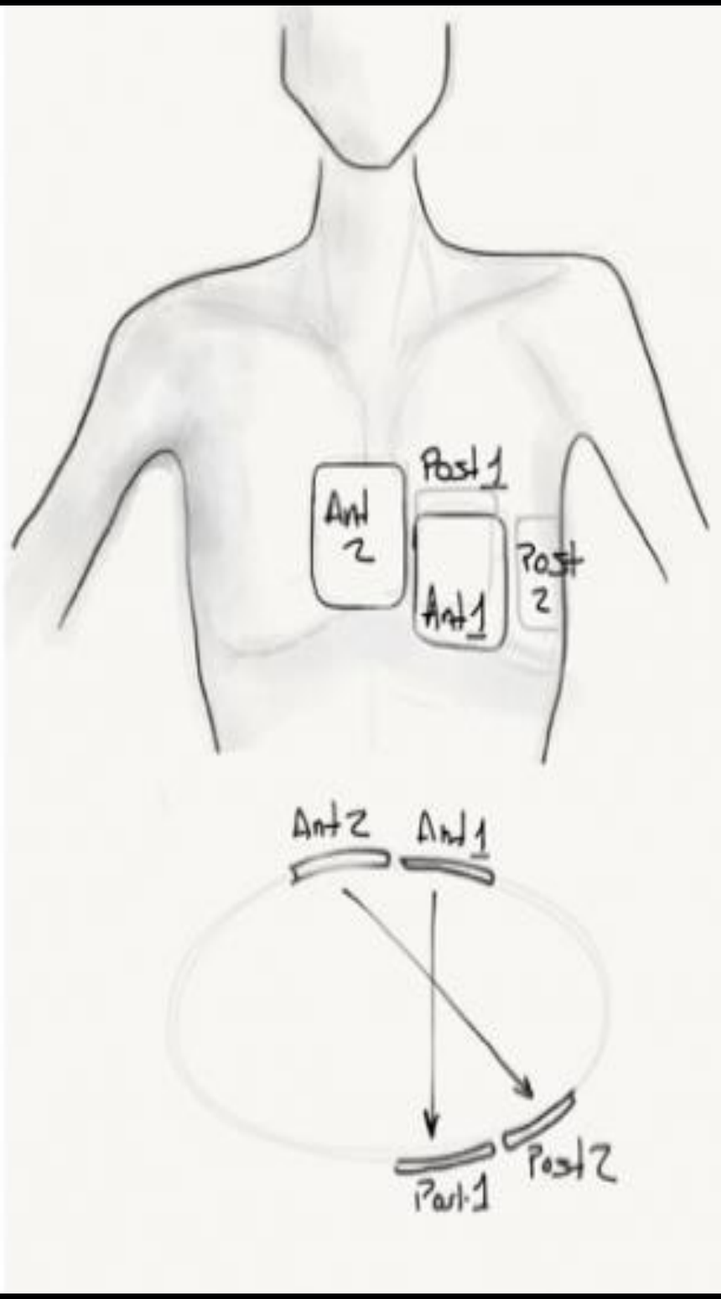
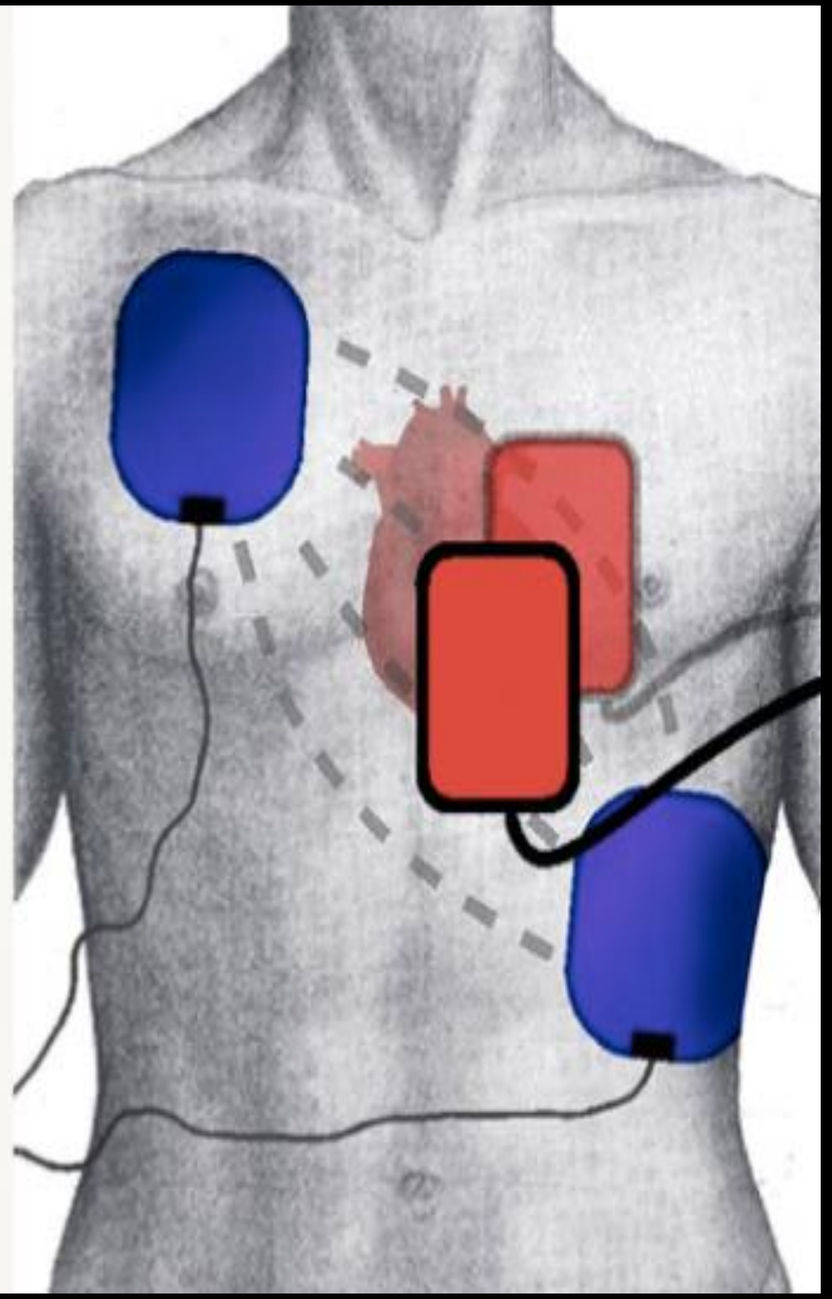
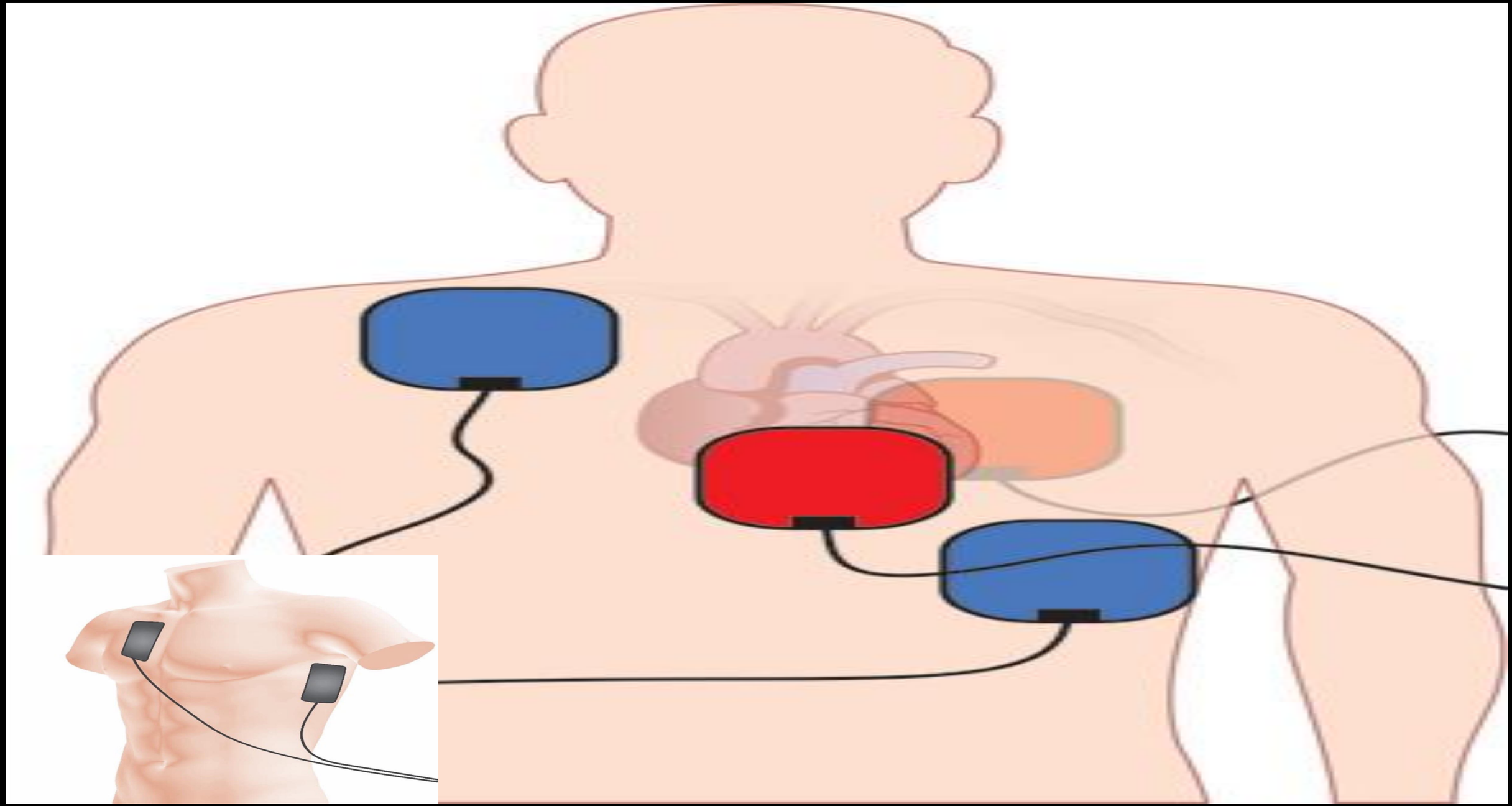


Figure 1. Placement of defibrillator pads.

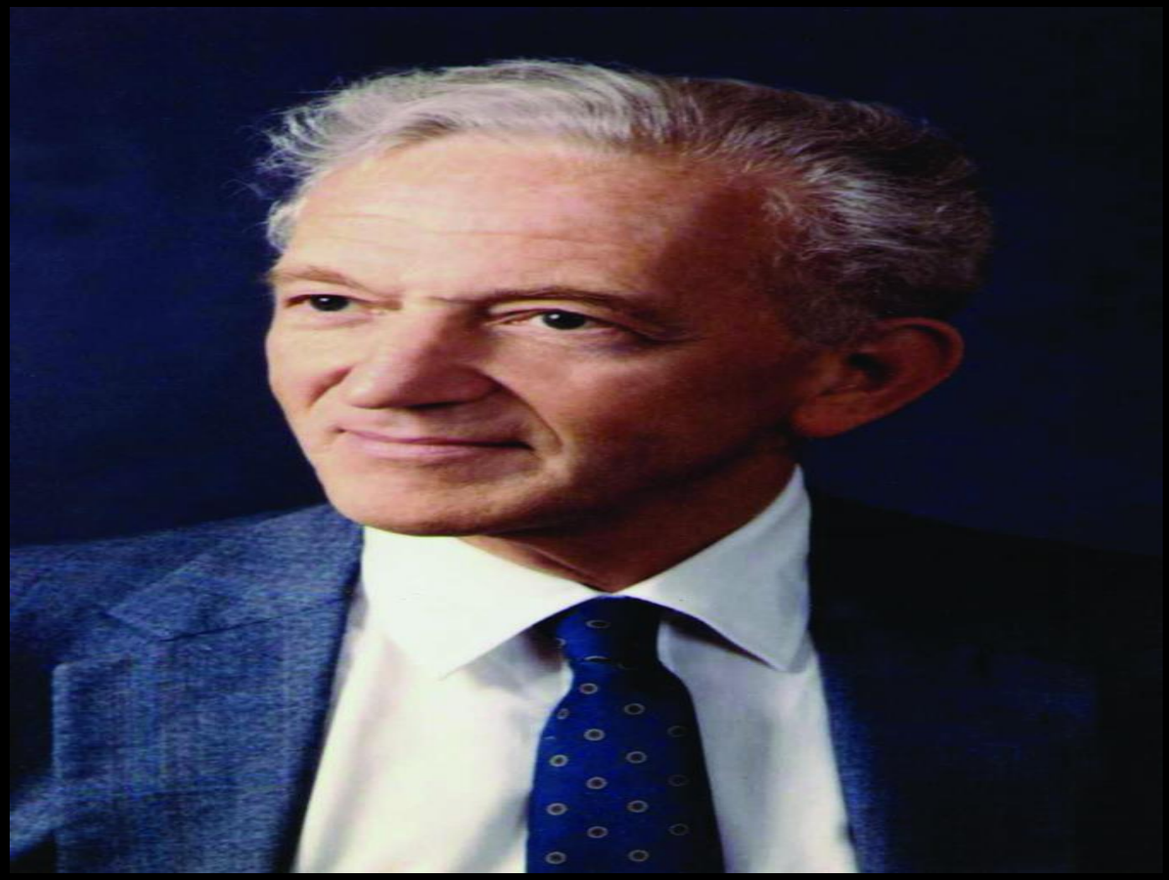






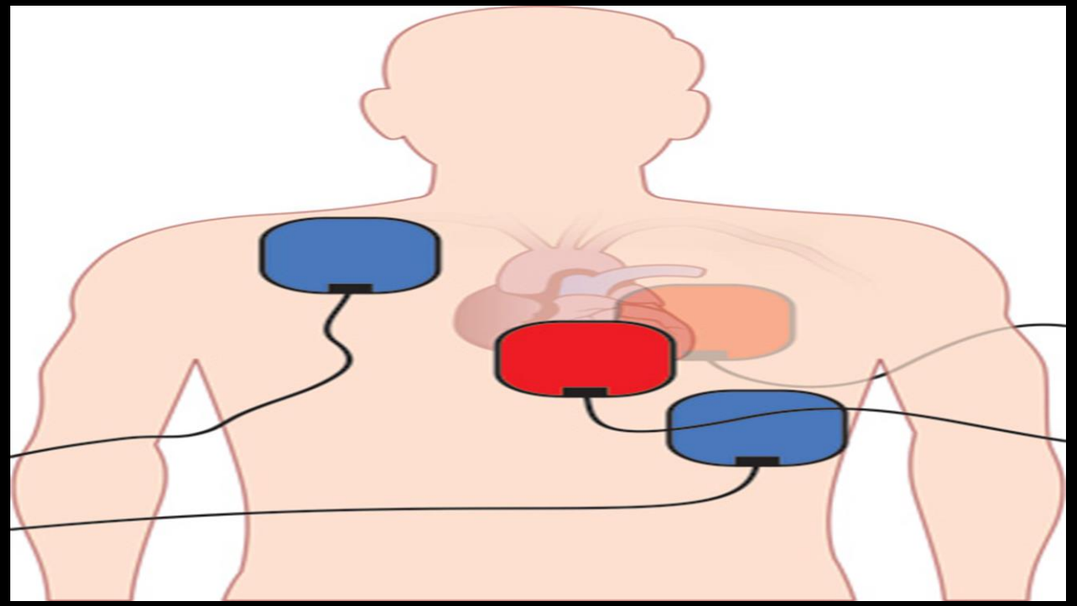
Efficacy of DSD

- ***Routine use*** **of DSD is not recommended?**



ACLS 2020 & DSD

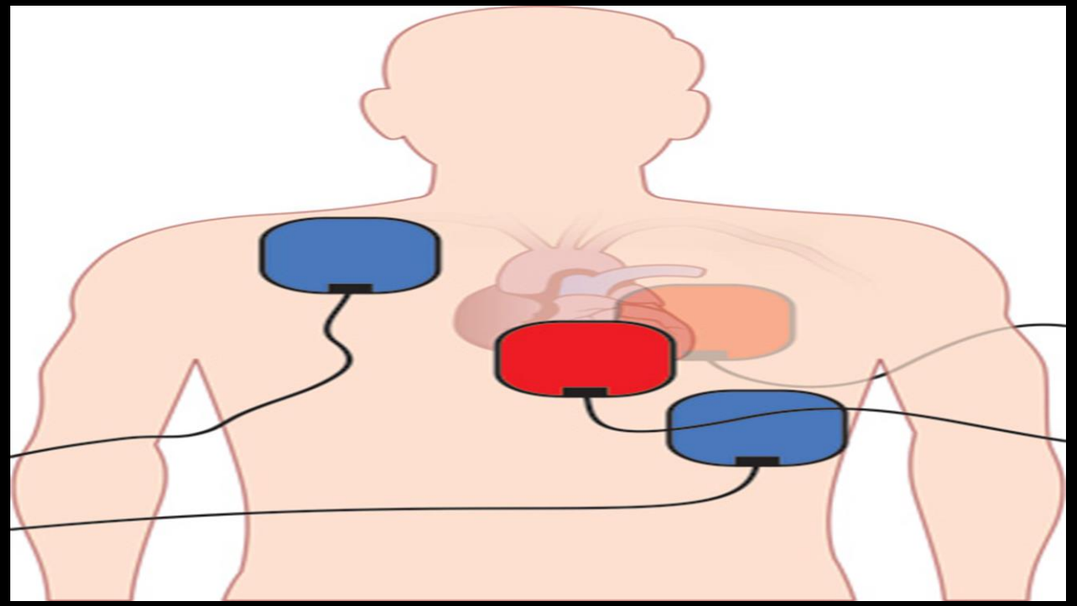
- **Knowledge Gap**
  - **High-quality studies comparing DSD with standard defibrillation**



ACLS 2020 & DSD

- **Suggest against *routine use* of DSD**

- **Requires**
  - **Training of staff**
  - **Available defibrillators**
  - **Track adverse events**
    - **Harm to patient**
    - **Defibrillator damage**




DON’T CROSS THE STREAMS

External Defibrillator Damage Associated With Attempted Synchronized Dual-Dose Cardioversion

Neal S. Gerstein, MD, FASE*; A. Robb McLean, MD, MHCM; Eric C. Stecker, MD, MPH; Peter M. Schulman, MD

*Corresponding Author. E-mail: ngerstein@gmail.com.

The simultaneous use of 2 external defibrillators to administer either dual or sequential cardioversion or defibrillation for refractory cardiac arrhythmias is increasing in both the out-of-hospital and inhospital settings. Using 2 defibrillators to administer higher energy levels than can be achieved with a single defibrillator is considered off-label and is currently not part of published advanced cardiac life support guidelines. We report the first case in which the use of dual-dose cardioversion was associated with external defibrillator damage. Because defibrillator damage, especially if undetected, jeopardizes patient safety and off-label medical product use may void the manufacturer's warranty, this case should urge users to proceed with caution when contemplating this technique. [Ann Emerg Med. 2017;■:1-4.]

0196-0644/$-see front matter

http://dx.doi.org/10.1016/j.annemergmed.2017.04.005

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journal homepage: www.elsevier.com/locate/resuscitation-plus

Clinical paper

A survey of the incidence of defibrillator damage during double sequential external defibrillation for refractory ventricular fibrillation

Ian R. Drennan[a,b,c,*], *Dustin Seidler*[d,e], *Sheldon Cheskes*[c,f,g]

Conclusion: When DSED is used, rate of defibrillator damage appears to be exceedingly low.

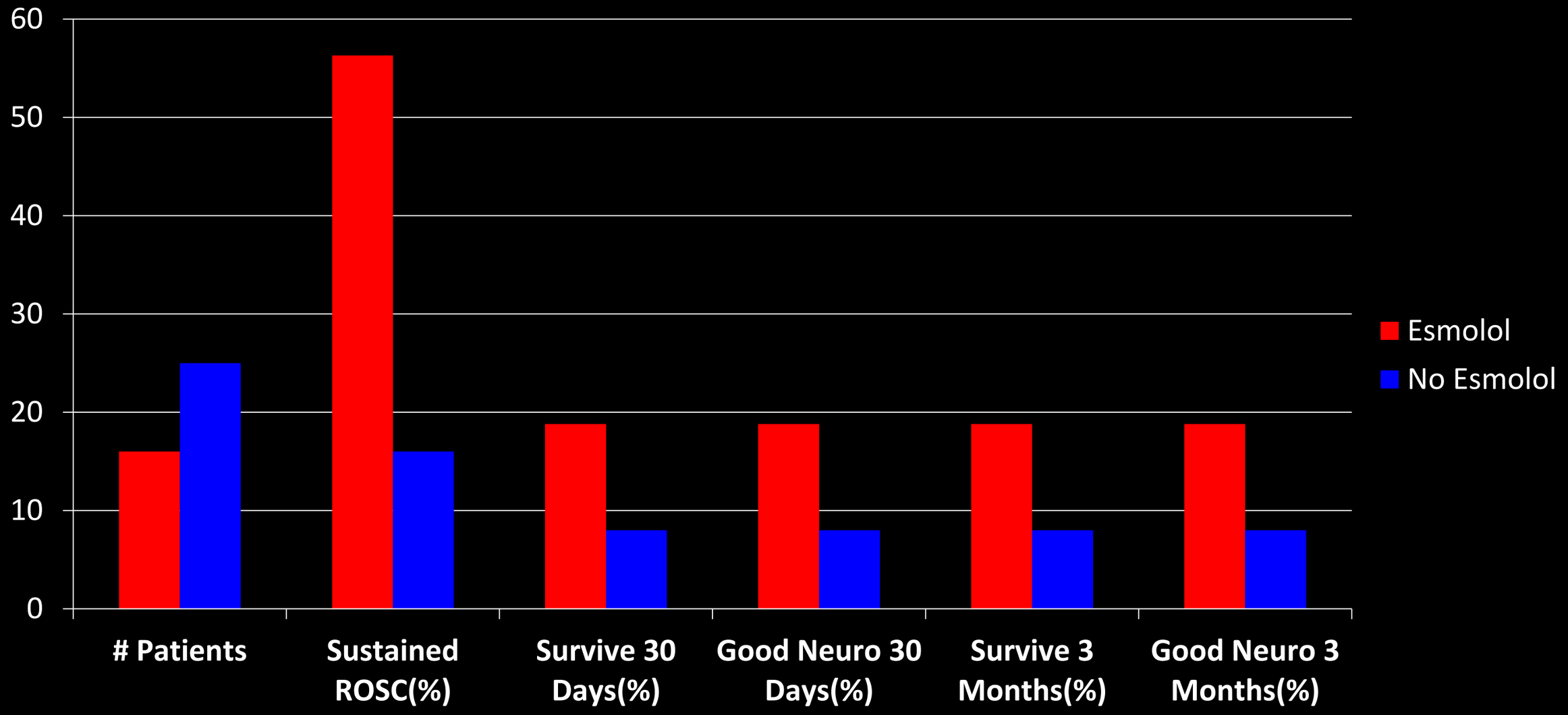

ESMOLOL
HCl INJECTION
FOR IV USE
100 mg/10 mL
(10 mg/mL)
Rx ONLY

Refractory VF Treated with Esmolol

- Resuscitation October 2016

- 41 patients
- OHCA with refractory VF
- 25 No Esmolol
- 16 Esmolol
- Load 500mcg
- Infusion 0 – 100mcg/kg/min

rVF Treated with Esmolol

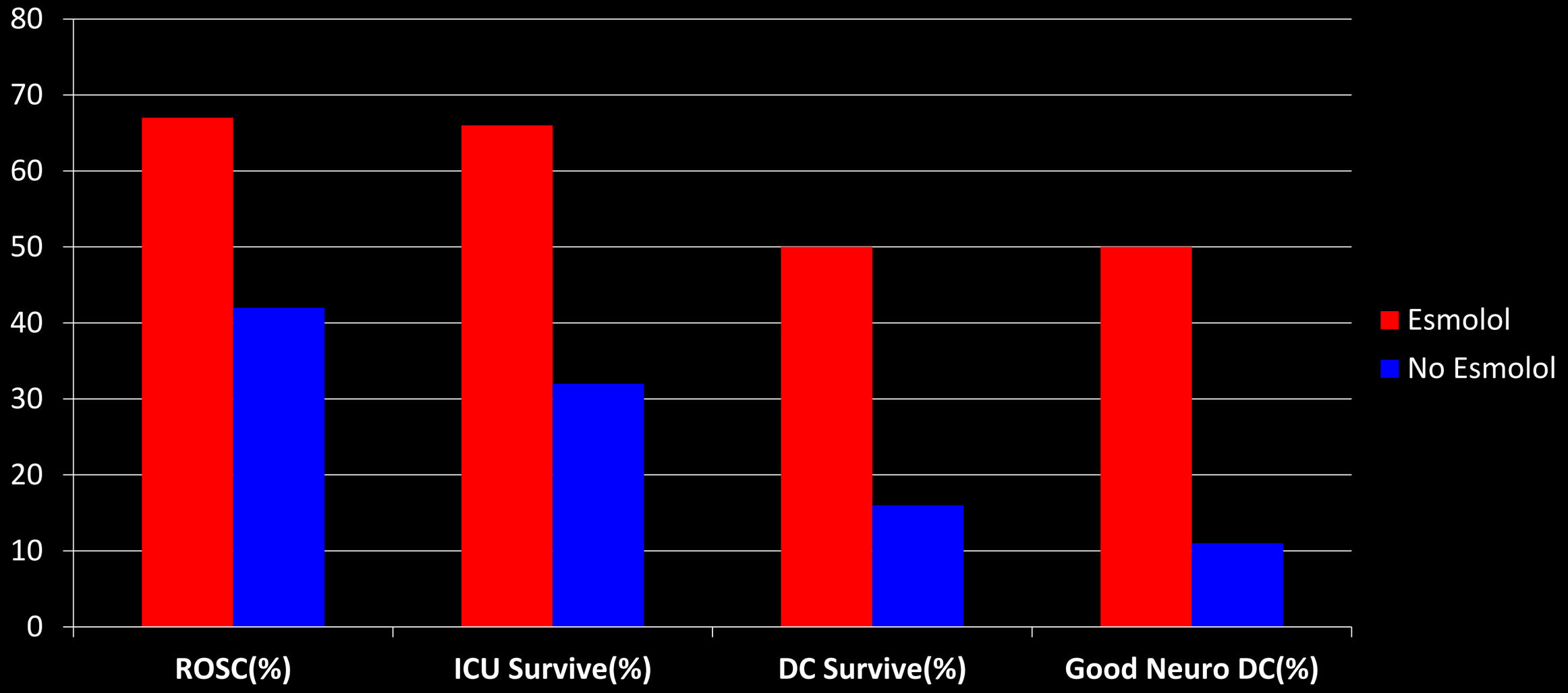


Esmolol After Failure Standard CPR with Refractory VF

- Resuscitation October 2014

- 25 patients
- 19 No esmolol
- 6 Esmolol

Esmolol After Failure Standard CPR with Refractory VF



First Report of Survival in Refractory VF after DSD and Esmolol

- Boehm et al
- November 2016
- Western Journal of Emergency Medicine

- 67 yom
- Hx LAD stent
- ED CP with CPA
- VF

- First 15 minutes
  - 5 single shocks
  - Epi 1 mg x 4 doses
  - Amiodarone 450mg

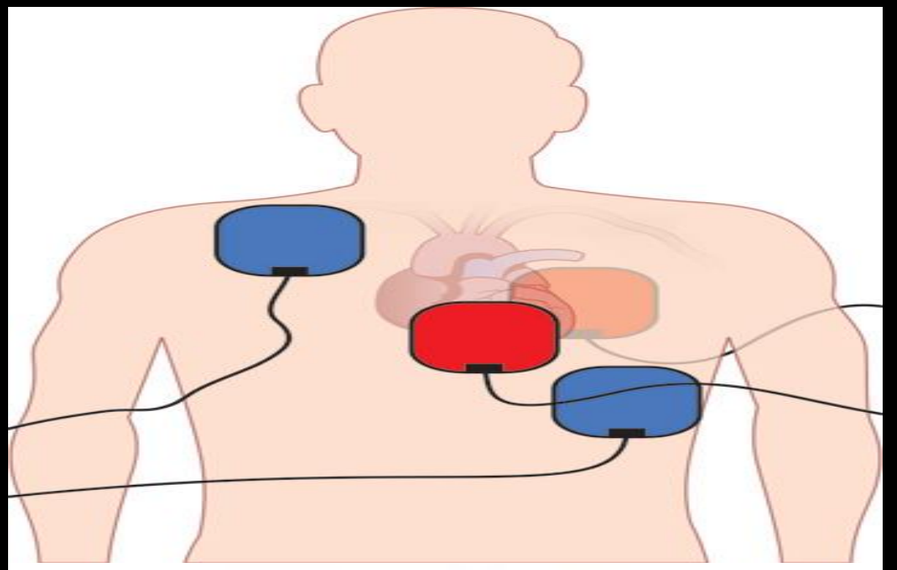
- Decision to use DSD & Esmolol

- DSD x 1, no change
- Esmolol 80mg IVP (~1000mcg/kg)
- Esmolol 0.1mg/kg/hr (~133mcg/kg/min)

- Circulated x 3 minutes

- 2nd DSD with ROSC and waking up

- Cath lab with LAD lesion/stent



Received: 14 December 2021 | Revised: 16 February 2022 | Accepted: 18 February 2022

DOI: 10.1002/emp2.12700

JACEP OPEN

WILEY

ORIGINAL RESEARCH

Emergency Medical Services

Feasibility of prehospital esmolol for refractory ventricular fibrillation

Casey Patrick MD[1] | **Remle P. Crowe PhD, NREMT**[2] | **Brad Ward EMT-P**[1] | **Ali Mohammed DO**[3] | **Kelley Rogers Keene BSN, RN**[4] | **Robert Dickson MD**[1,4]

[1]Montgomery County Hospital District EMS, Conroe, Texas, USA

[2]ESO Inc., Austin, Texas, USA

[3]Department of Emergency Medicine, HCA Houston Healthcare Kingwood, Kingwood, Texas, USA

[4]Department of Emergency Medicine, Baylor College of Medicine, Houston, Texas, USA

Abstract

Background: Esmolol may increase survival for patients with refractory ventricular fibrillation (RVF); however, information related to esmolol use in the prehospital environment is limited. We aimed to assess the feasibility of prehospital bolus dose esmolol for patients with RVF treated by a high-volume, ground-based emergency medical services (EMS) agency.

Esmolol, vector change, and dose-capped epinephrine for prehospital ventricular fibrillation or pulseless ventricular tachycardia

Kyle Stupca et al. Am J Emerg Med. 2022.

Conclusions: Patients who received the EMS bundle achieved sustained ROSC significantly less often and were less likely to have pulses at hospital arrival. The incidence of neurologically intact survival was low and similar between groups.

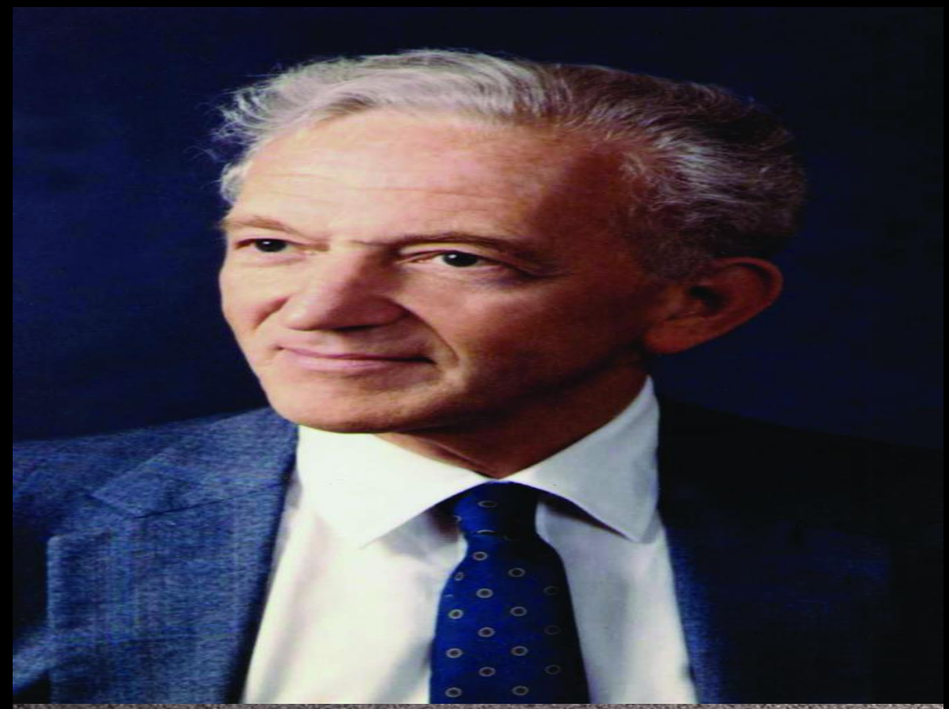
Stellate Ganglion Block (SGB)

SGB Indications

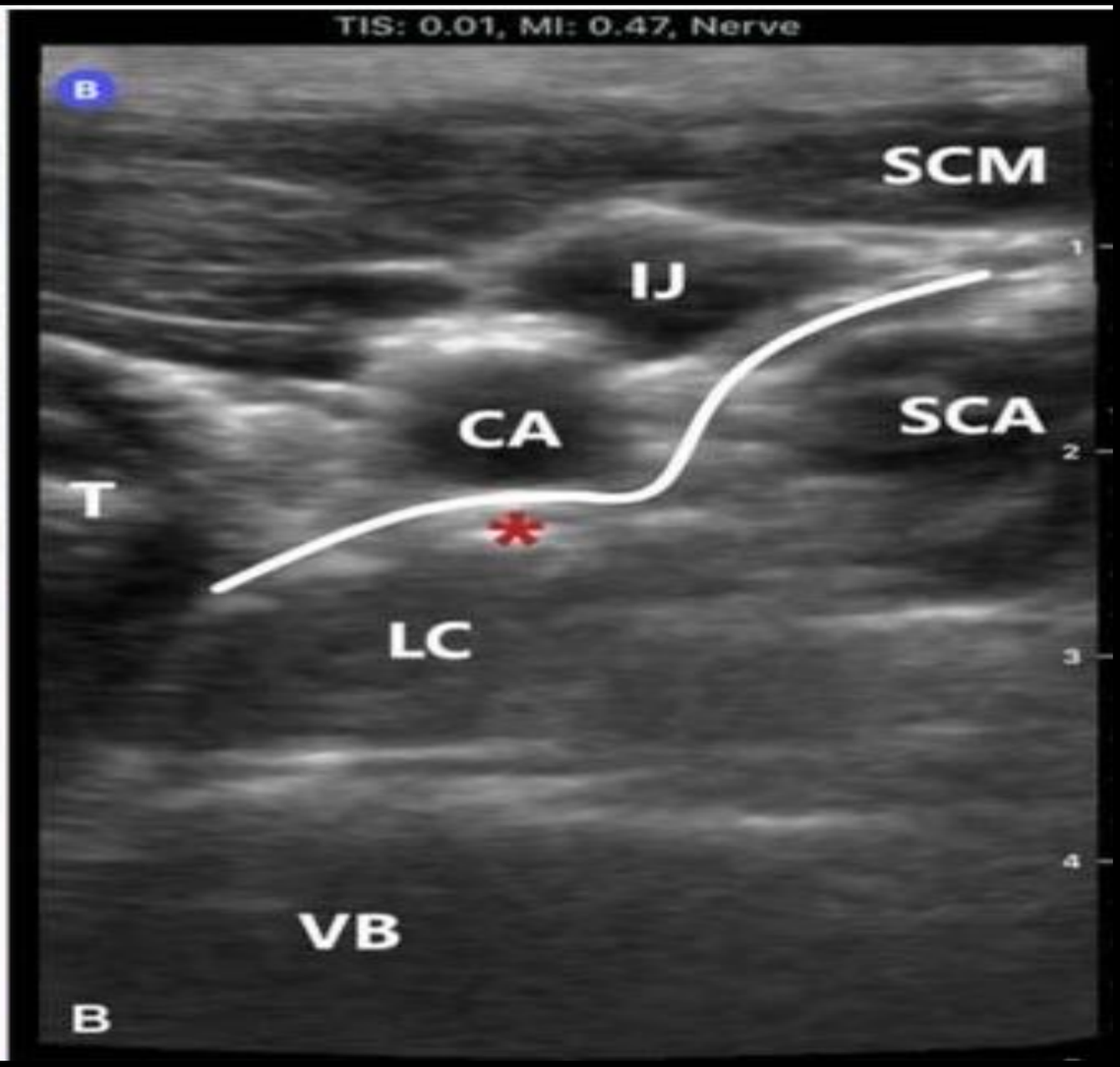
- Ventricular Storm
- rVF
- Persistent VT
- Drug refractory electrical storm
- Unresponsive to “traditional” therapies (ACLS)

Why?

- You have tried everything else
- Your patient is going to die
- “Heart too good to die” – Safar
- “Are my intentions honorable - Hinds



POCUS Guided SGB



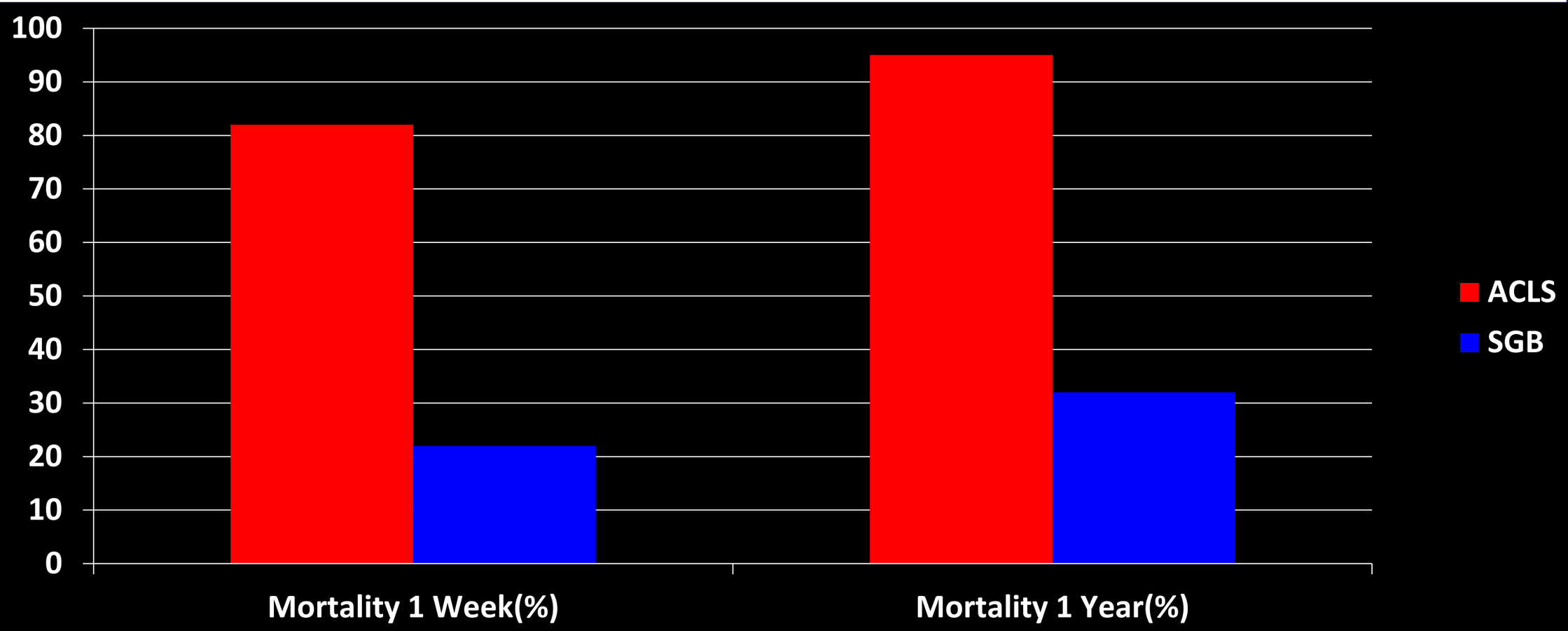
Clinical Trial > Circulation. 2000 Aug 15;102(7):742-7. doi: 10.1161/01.cir.102.7.742.

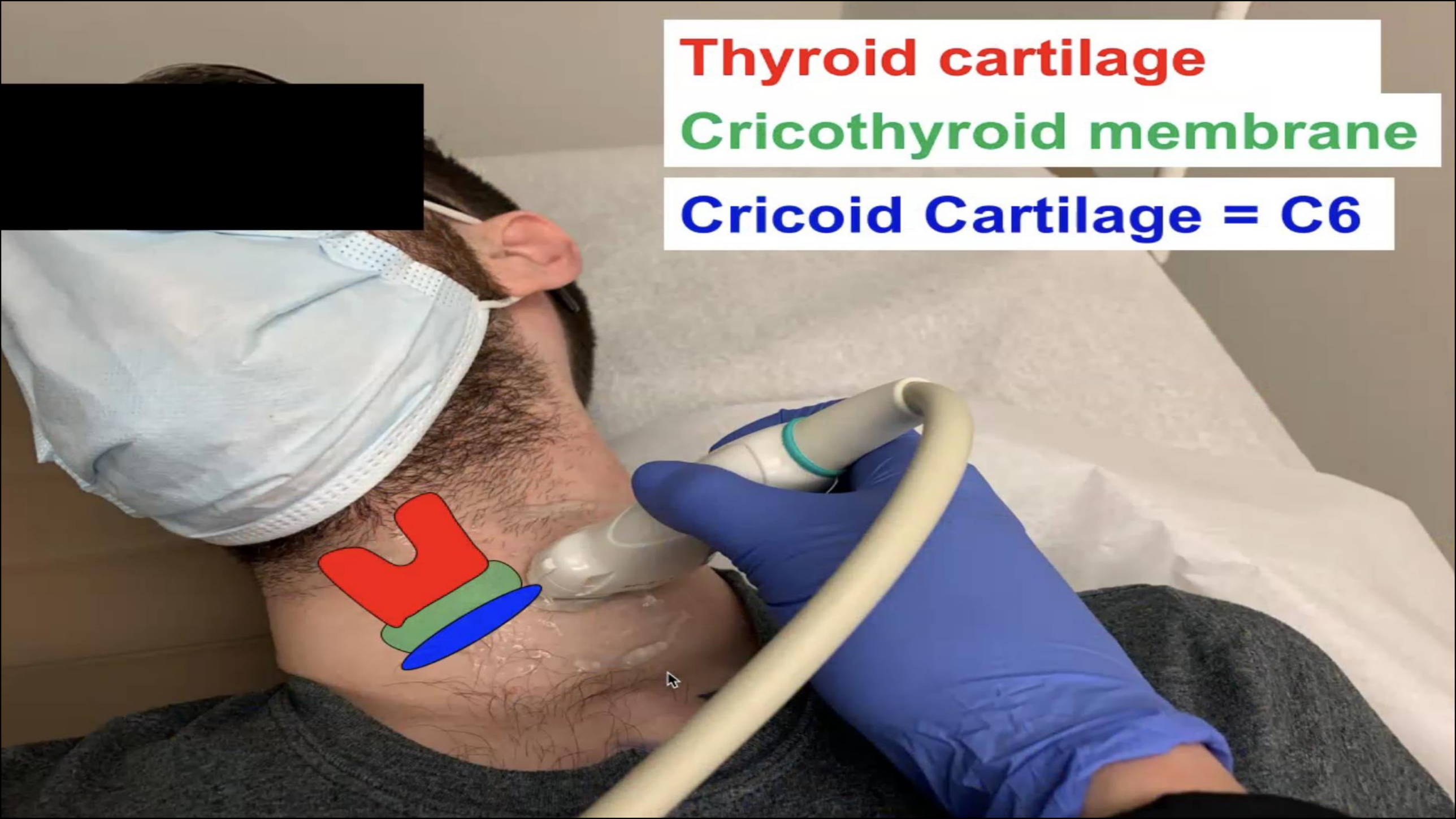
Treating electrical storm : sympathetic blockade versus advanced cardiac life support-guided therapy

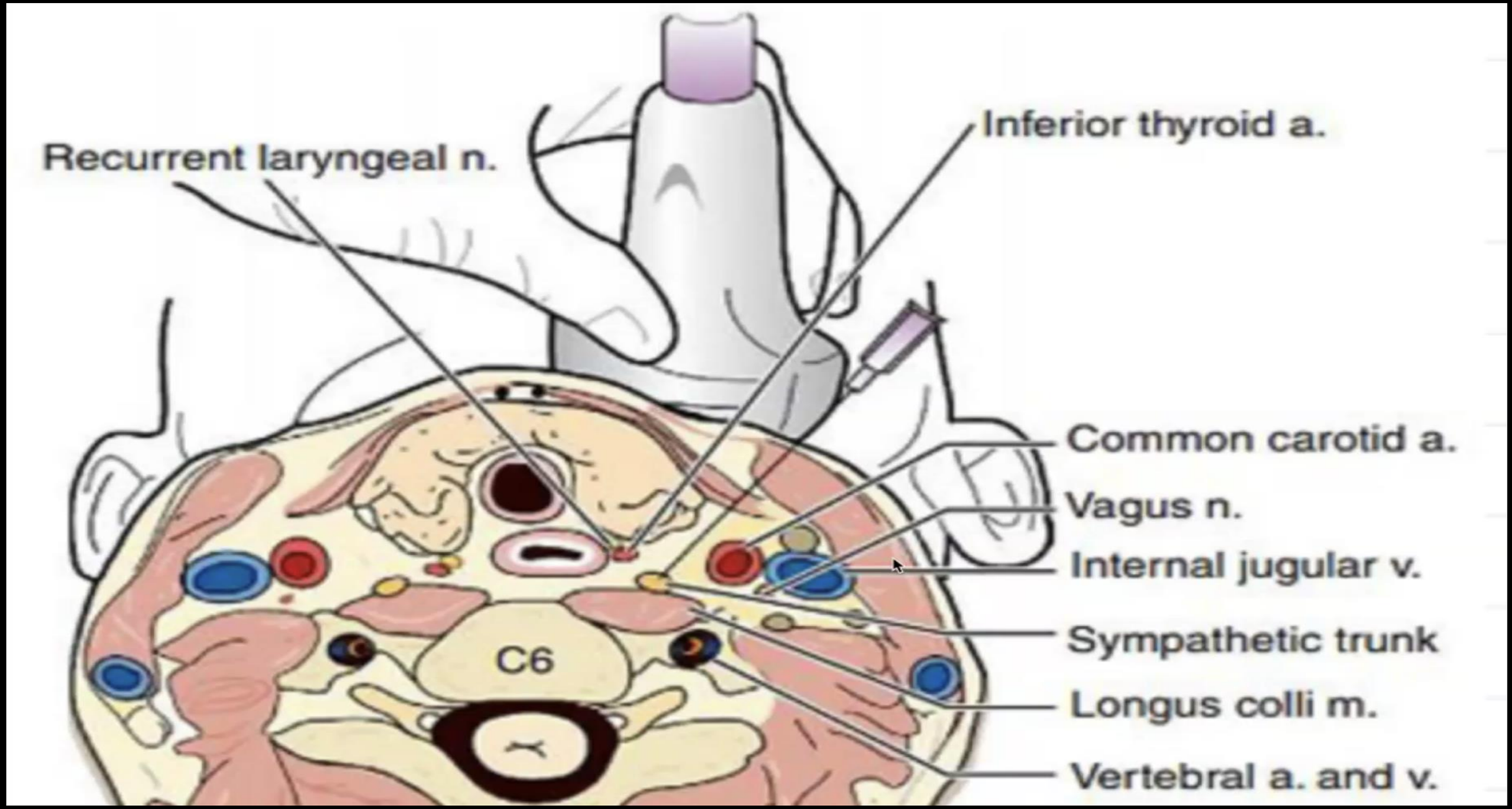
K Nademanee [1], R Taylor, W E Bailey, D E Rieders, E M Kosar

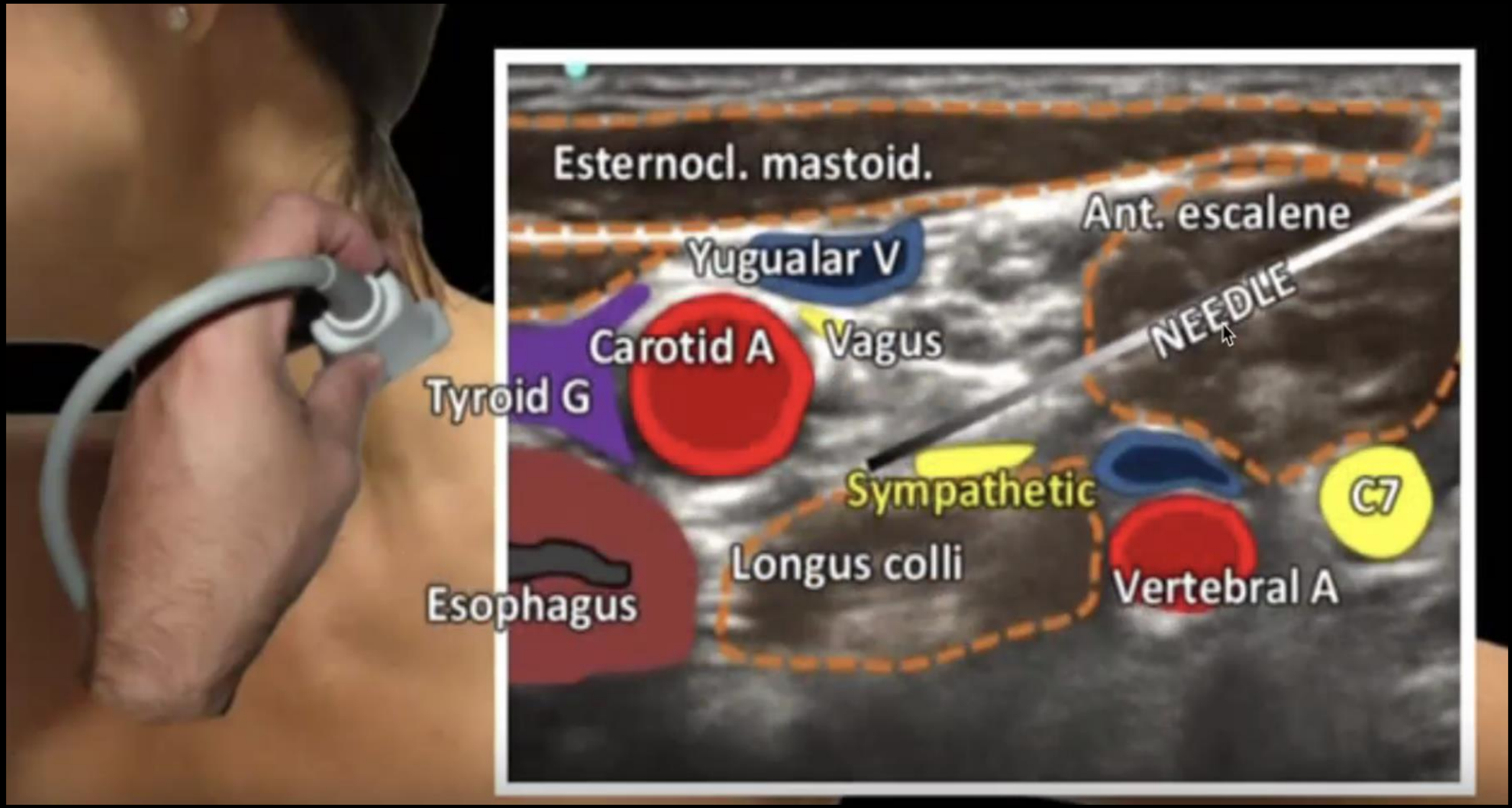
Affiliations + expand

PMID: 10942741 DOI: 10.1161/01.cir.102.7.742



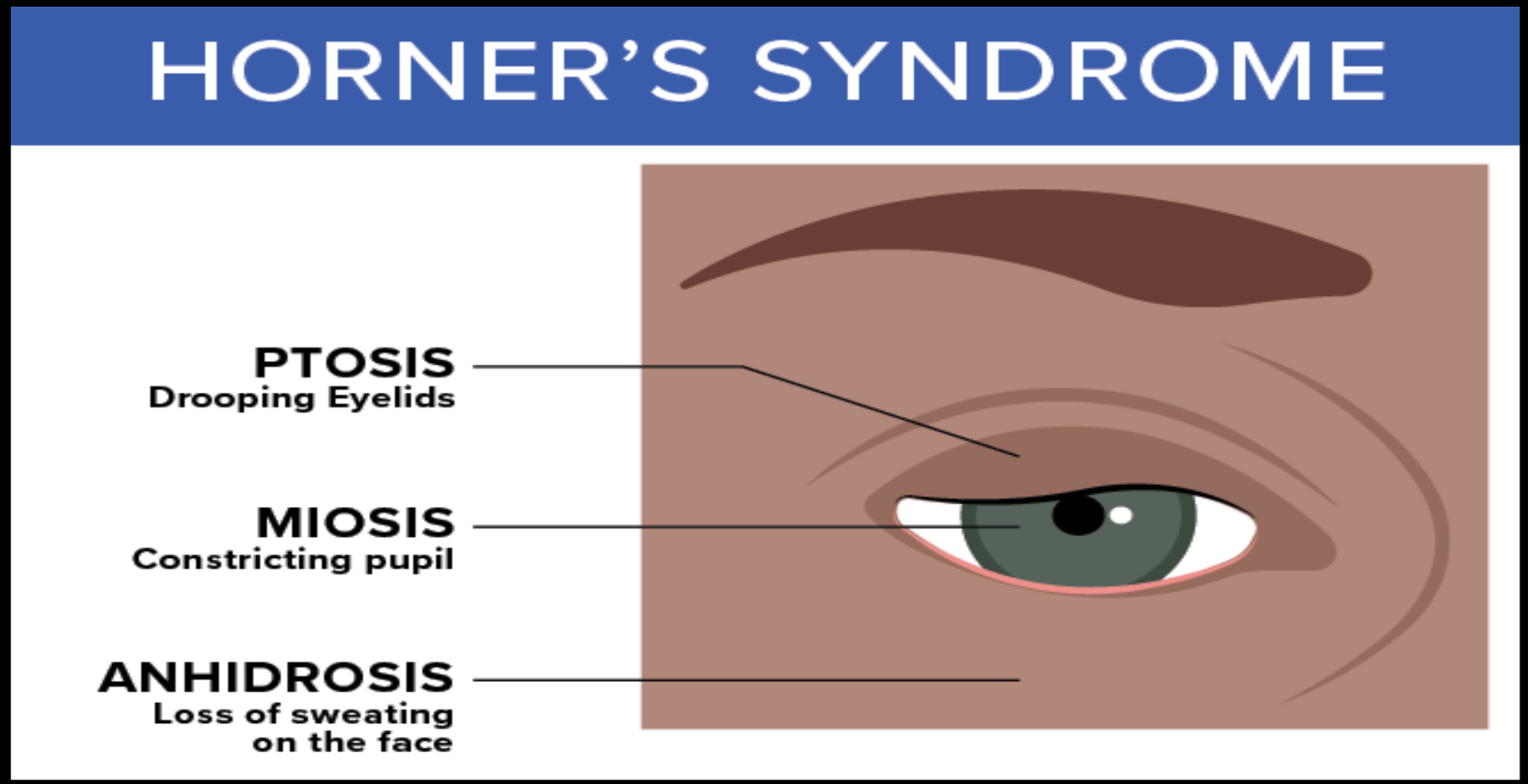

Thyroid cartilage
Cricothyroid membrane
Cricoid Cartilage = C6


Recurrent laryngeal n.
Inferior thyroid a.
Common carotid a.
Vagus n.
Internal jugular v.
Sympathetic trunk
Longus colli m.
Vertebral a. and v.
C6


Esternocl. mastoid.
Ant. escalene
Yugualar V
NEEDLE
Carotid A
Vagus
Tyroid G
Sympathetic
C7
Longus colli
Vertebral A
Esophagus

Successful SGB

- **Termination of VF**



PREHOSPITAL

ECMO

VF ARREST

ARREST Study (2020)

- The ARREST trial
- Yannopoulos D, et al. Advanced reperfusion strategies for patients with out-of-hospital cardiac arrest and refractory ventricular fibrillation (ARREST)
- Lancet. 2020 Nov 12:S0140-6736(20)

Patients

- Adult patients (aged 18-75) OOHCA
- Initial rhythm VF/VT
- No ROSC after three defibs,
- Body size that fit the Lund CPR Assist System (LUCAS)
- Estimated transfer time to the emergency department of less than 30 minutes.

Exclusions

- DNR
- Trauma or burns
- Drowning
- Overdose
- Pregnancy
- Nursing home resident
- Unavailability of the cath lab
- Contraindications to angiography
- Contrast allergy
- Active GI or internal bleeding.

Intervention

- **ECMO (V-A)**
  - **Straight to cath lab by EMS placed on ECMO.**
  - **There were strict criteria used to discontinue resuscitation in this group**
    - **Two or more of the following:**
      - **End-tidal CO_2 <10 mm Hg**
      - **PaO_2 <50 mm Hg or oxygen saturation <85%**
      - **Lactic acid >18 mmol/L).**

Comparison

- **Standard ALS**
  - **The protocol dictated that resuscitation efforts had to continue for at least 15 minutes after ED arrival and at least 60 minutes after the 911 call.**

Outcome

- **The primary outcome was survival to hospital discharge.**

Results

- 30 patients, mean age of 59 years, 83% men.
- Large improvement in the primary outcome of survival to hospital discharge (43% versus 7%).
- Survival to 6 months also better ECMO group (43% vs 0%).


ECMO
MN Mobile Resuscitation Consortium
ECMO
MN Mobile Resuscitation Consortium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curaplex


ECMO
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ECMO
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DY


Director
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MN Mobile Resuscitation Consortium
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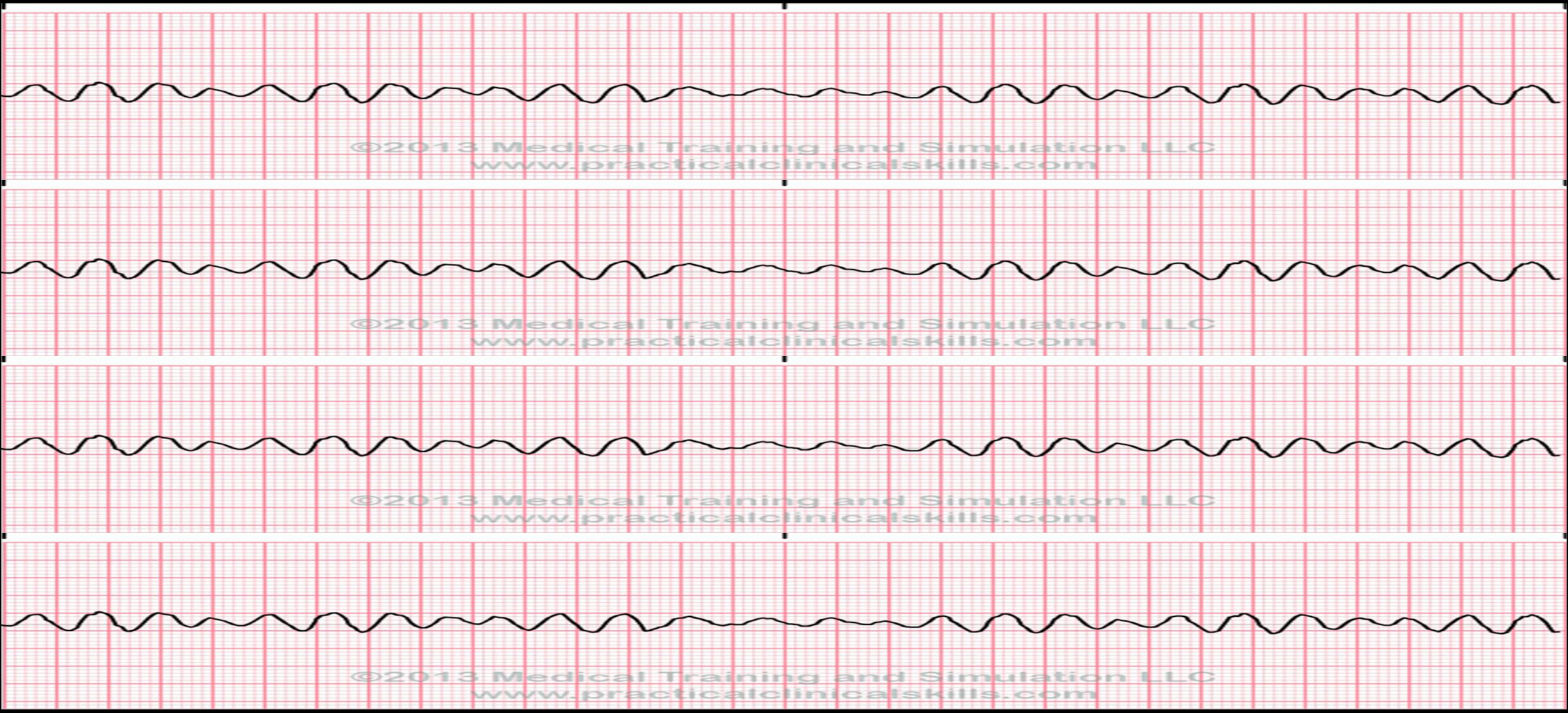
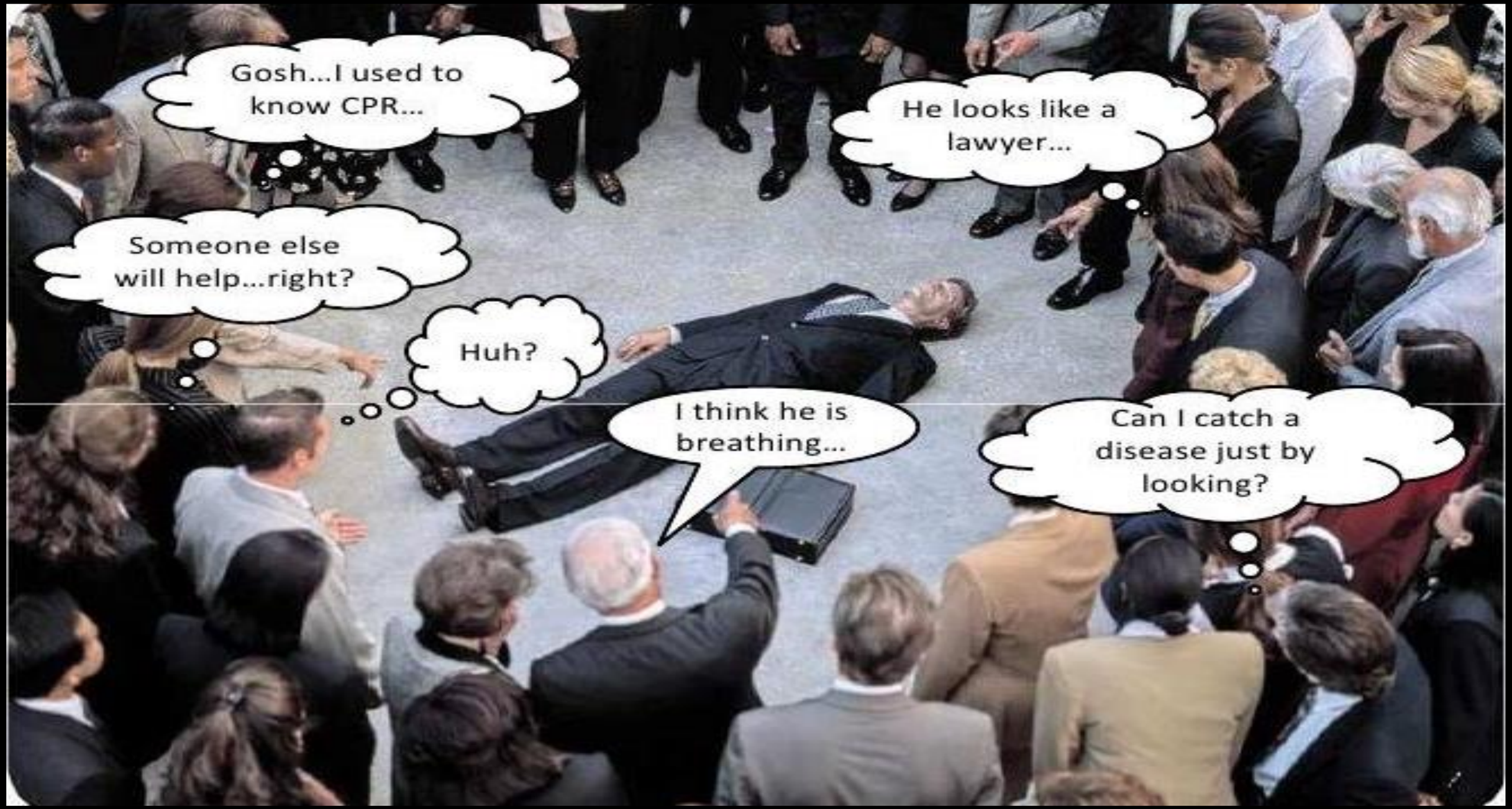
ECMO

A Success Story




WAFFLE HOUSE
WAFFLE HOUSE

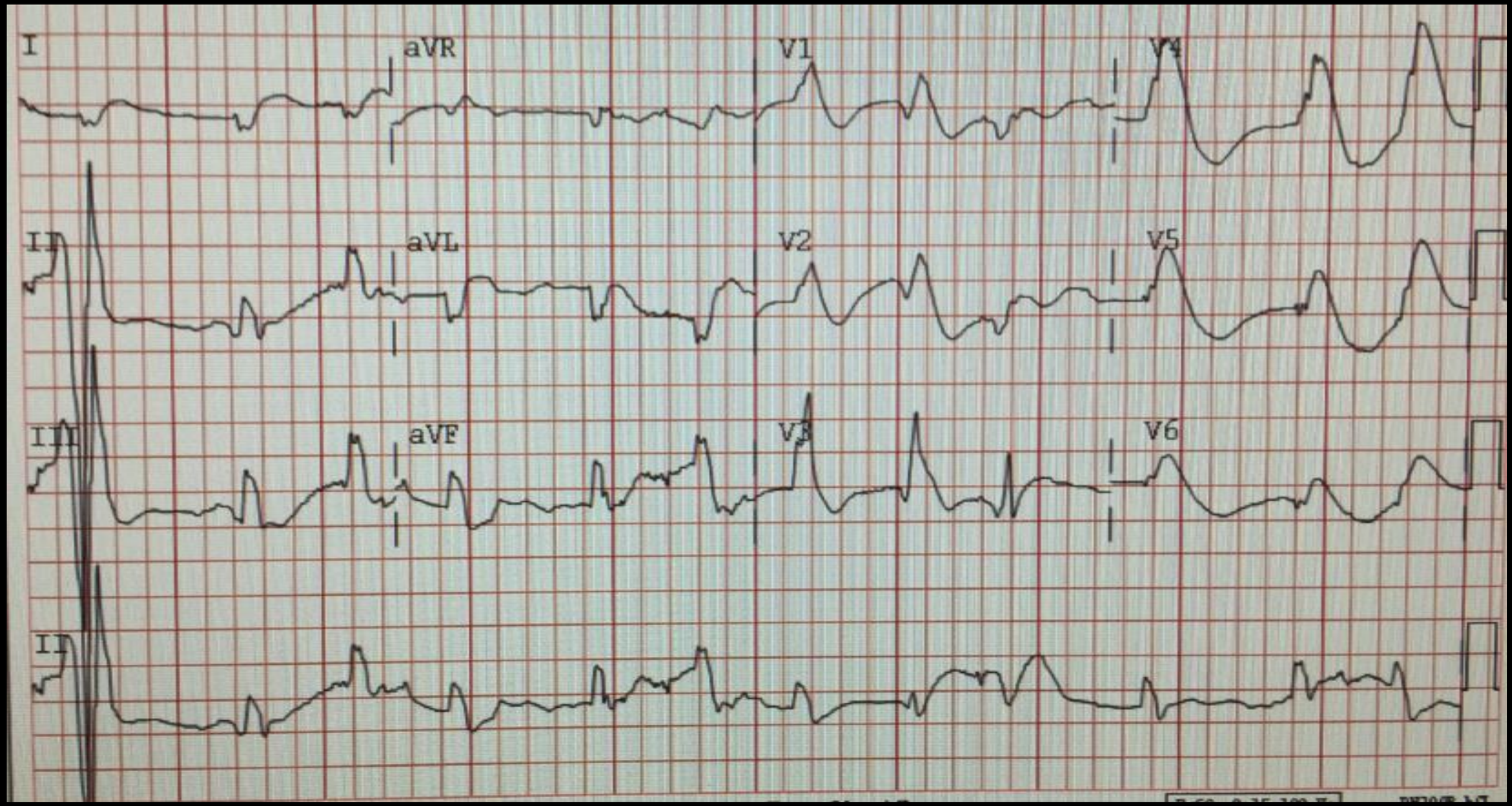

Gosh...I used to know CPR...
He looks like a lawyer...
Someone else will help...right?
Huh?
I think he is breathing...
Can I catch a disease just by looking?

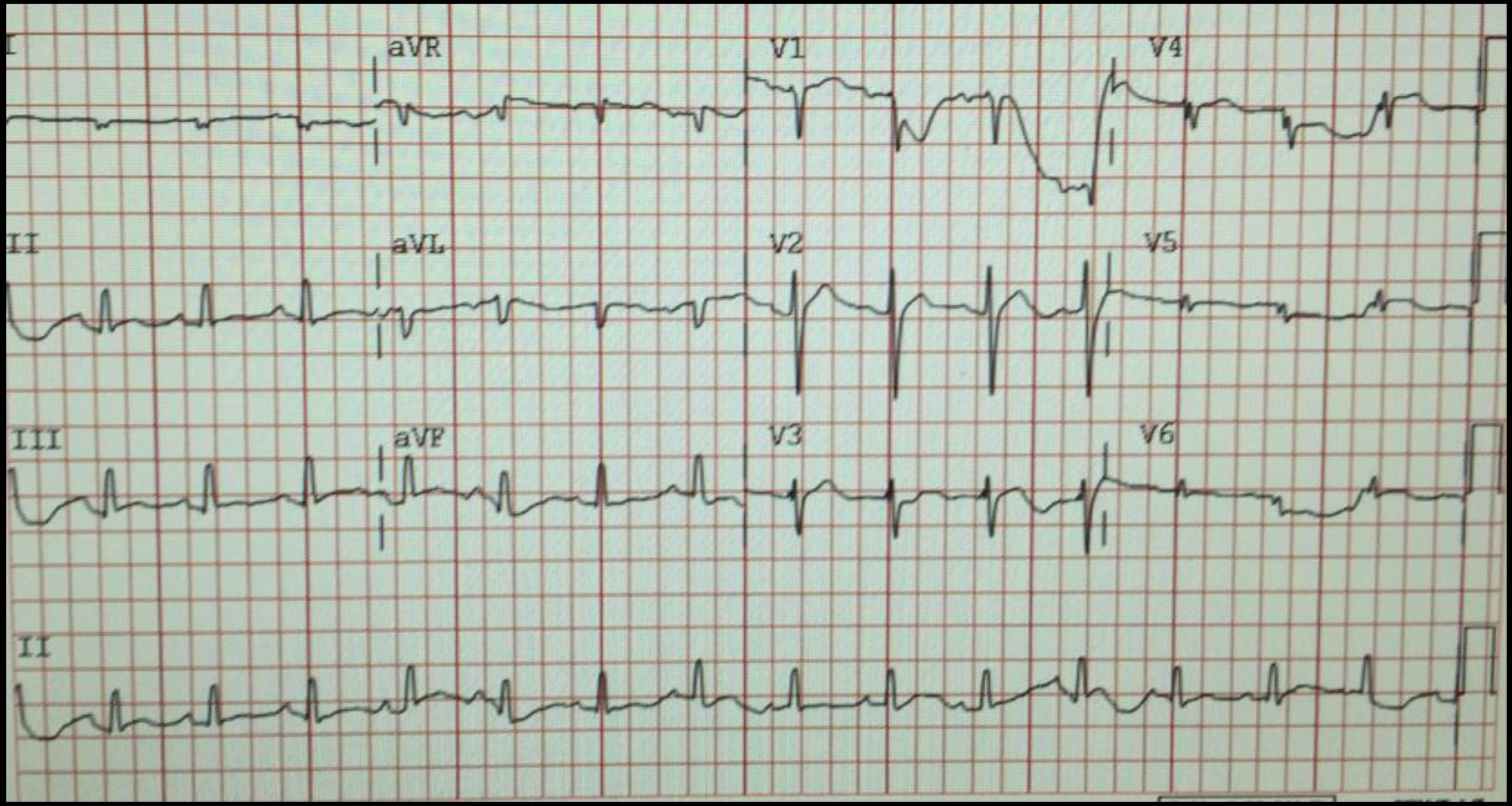

AMBULANCE
AMBULANCE
PARAMEDIC


Say
What?


LIFEPAK 15
75
152
83


LIFEPAK 15
75
152
83


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II


I
aVR
V1
V4
II
aVL
V2
V5
III
aVF
V3
V6
II

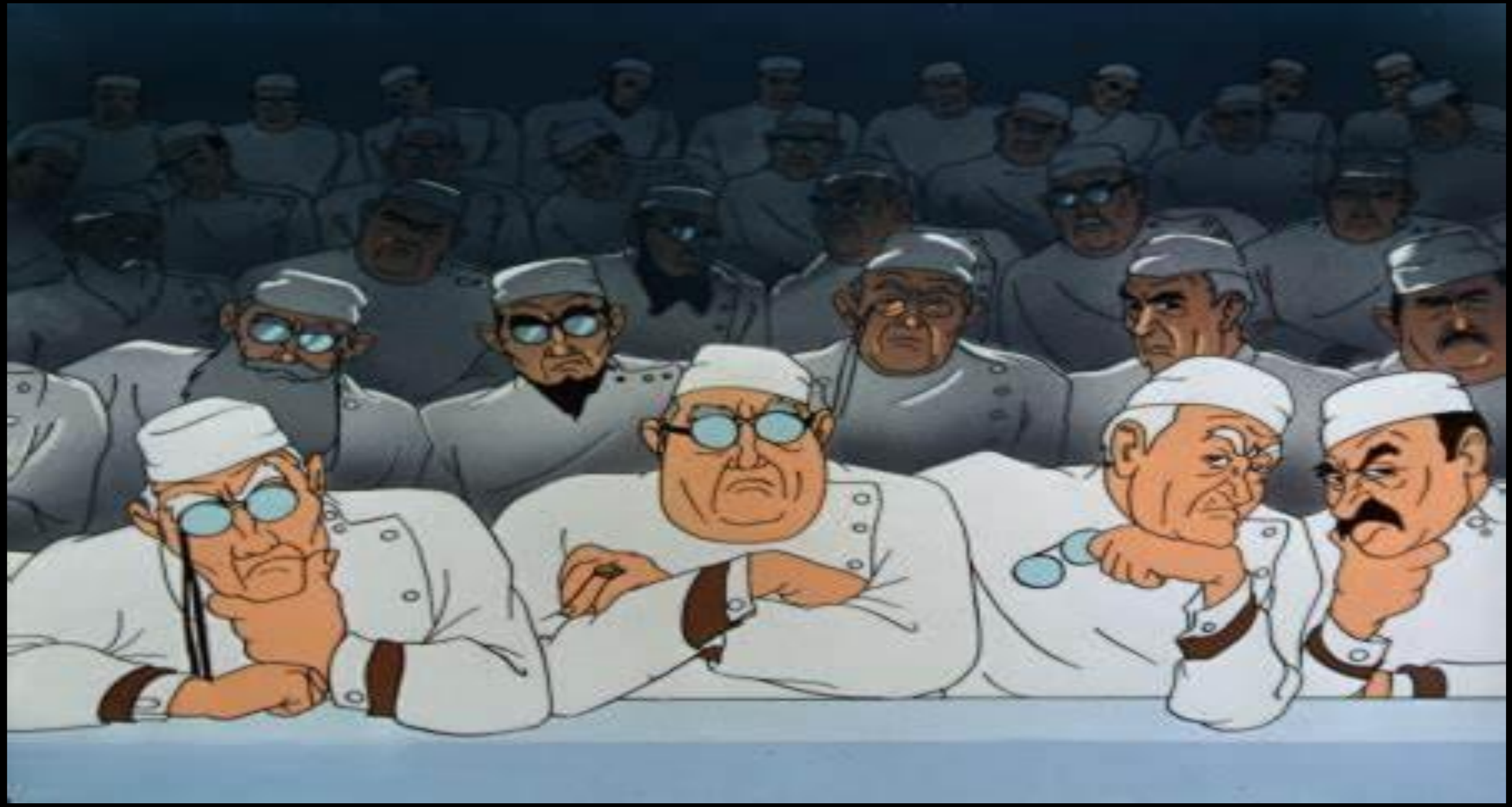
When you get pulses back and they ask what you want done next

Better Method Refractory VF?

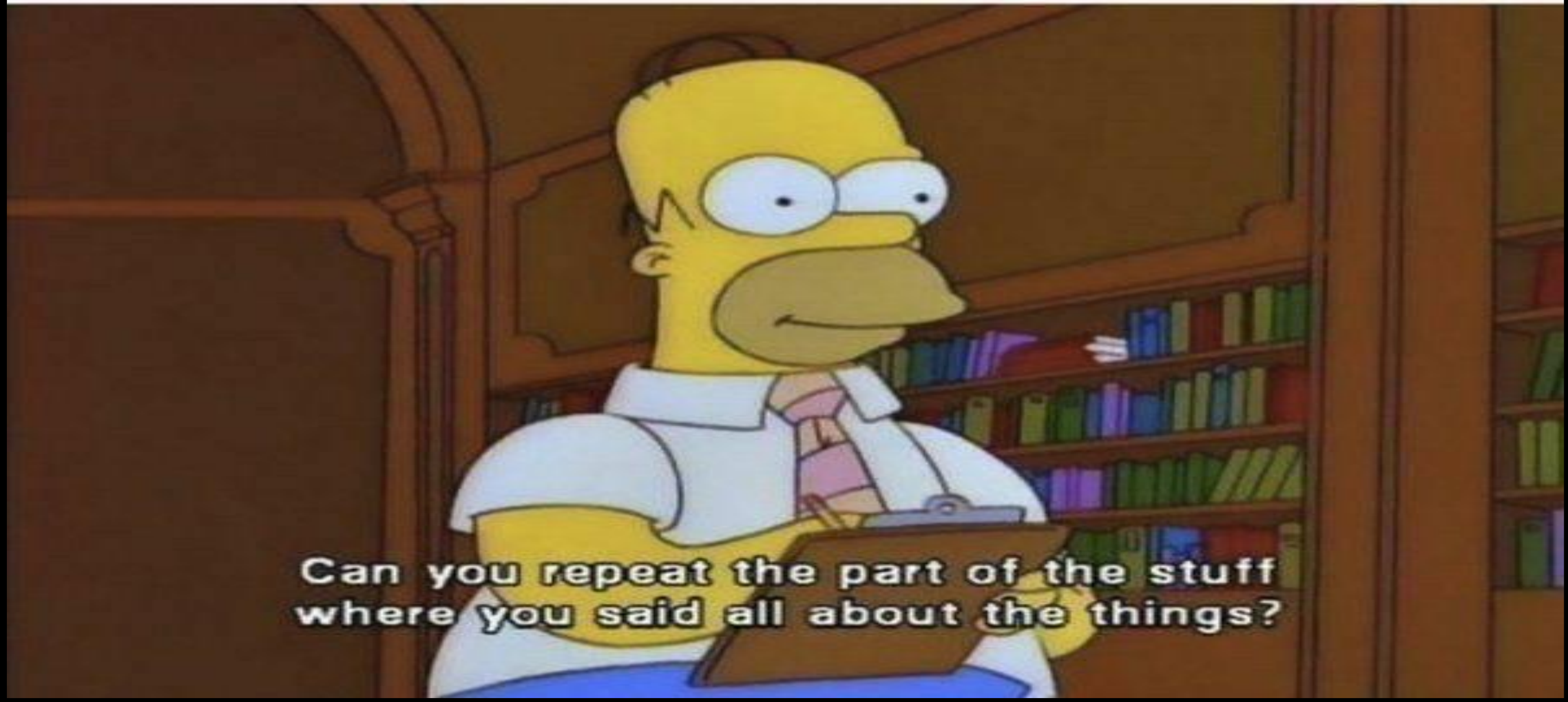
- High quality CPR, limited interruption
- Early defib → Early change vector → Early DSD
- Limit epinephrine
- Esmolol bolus and infusion

Summary

- rVF
  - High quality CPR, Prompt Defib
  - ? Limit Epi, ? Lidocaine, ? Amiodarone, ? Bretylium
  - Consider defib vector change
  - Consider DSD, Esmolol
  - Consider SGB
  - Prehospital / ED ECMO



when your lecturer asks if you have any questions



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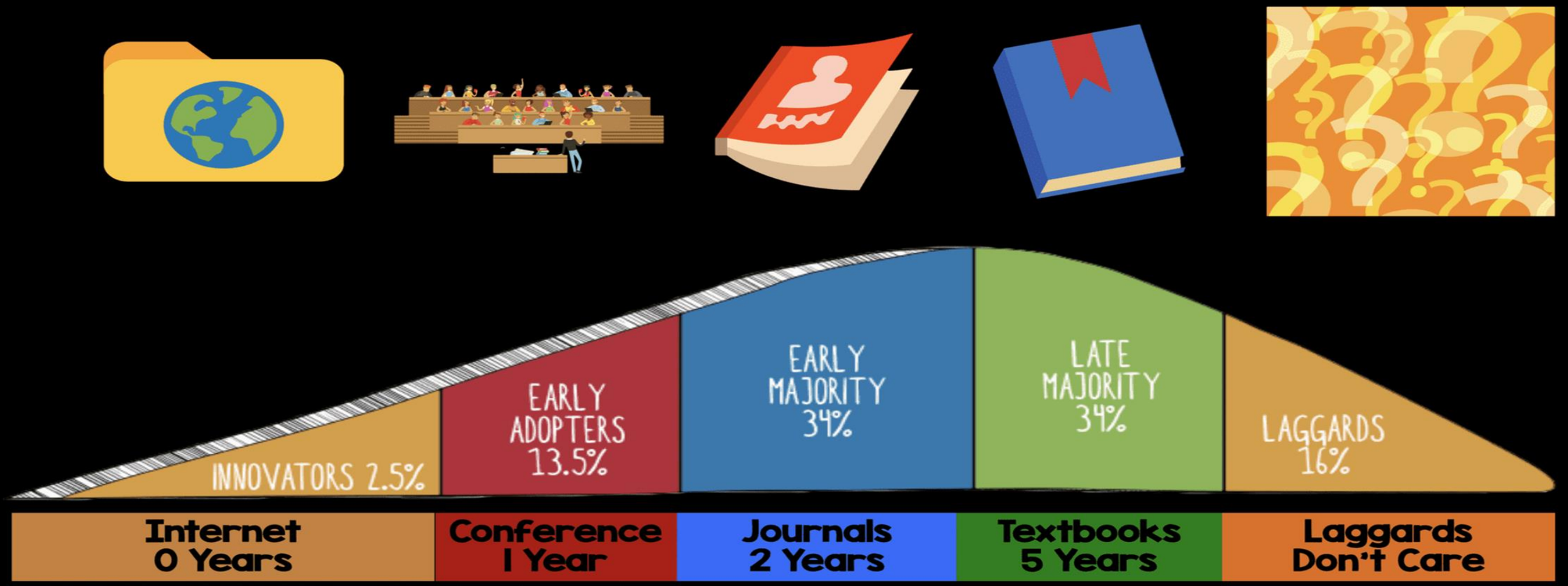
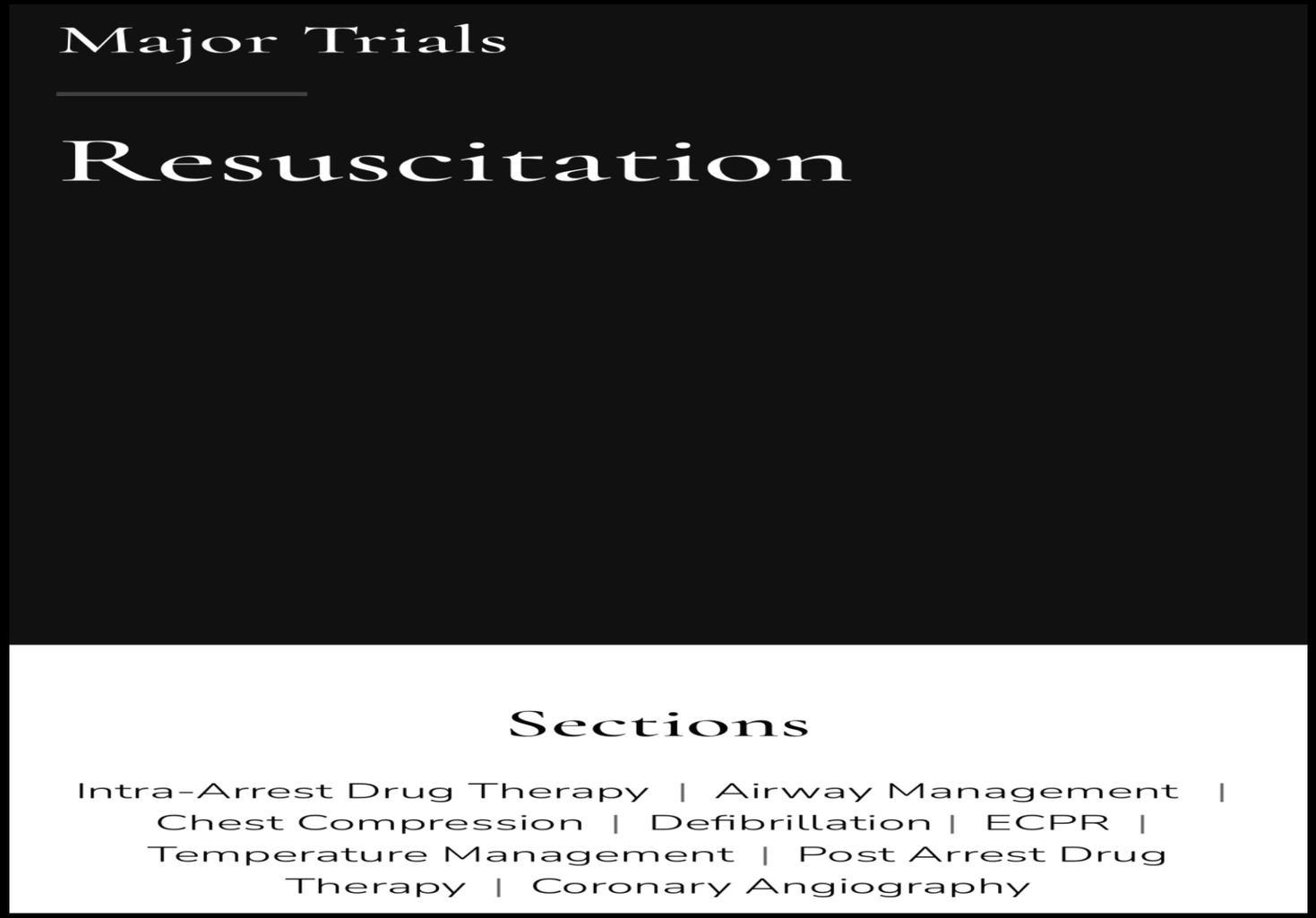


CriticalCareReviews.com



Andrew Bowman

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Greater Indianapolis

09:55 92

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@AndrewACNP1

Acute Care Nurse Practitioner TNS Paramedic Emergency Department Original #FOAMed Airway & EKG Geek Indiana Janus General ER Staff FAEN Fountain Pens JAFERNP

USA Joined December 2010

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