Dual Sequence Defibrillation

A Case Study in Refractory Ventricular Fibrillation

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Update: 04/25/2026

01

Imagine This...

Quiet night in the ER.

Sleeping patients, no call bells...

Catch up on reading.

Seriously! This happened!

What’s this? Dual Sequence Defibrillation?

Dr. Adal – “Sure, but what are the chances?”

The Emergency Room Gods… ”Hold my beer.”

CPR, BLS only, 10 minutes out

Report: Defib x 6, still doing CPR

Me: 🤘🤘

Dr. Adal: <eyebrow raised> “You’re kidding me. Let’s do this.”

Dr. Vizzuso “Someone want to fill me in on what’s going on?”

02

Calm is Smooth; Smooth is Fast

Intermission…

One of the coolest things I’ve ever received.

Now, on with our regularly scheduled program….

Staff

MD head of bed

Primary RN

RN - Document/Meds

Two techs - EKG and compressions

RT

Spectators outside of room – butts to the wall

Preparation

Two monitors on two code carts

12 Lead

IV/phlebotomy supplies

Ultrasound

Ventilator

History

Found unresponsive on sidewalk

Well-dressed

No ID

Small currency dollar bills in his pocket

No obvious signs of trauma

Pre-Hospital

CPR by BLS/PD (unknown downtime)

IN Narcan

Six defib prior to hospital

One more defib in ambulance bay

ER Arrival

Defib prior to transfer –

total of 8 defib

CPR resumed

EKG/Defibs attached

IO x 2 access

Charge and Delivery

Charge both defib to max (e.g. 200j biphasic)

Shock delivered in rapid succession (<1 second)

Some studies have two different providers delivering shock

Others have one (we did one).

Post Defibrillation

NSR w/ pulse

Lido, Mag

Intubated

Labs

Trop: 19K

K: 4.0

Mag: 2.5

Normal core temp – started hypothermia protocol

Other

EF ~30% with poor wall motion

Pan scan: temporal bone fracture

No bleed

Neuro

Myoclonic jerking

Keppra bolus

Versed and Propofol

Pinpoint pupils

Breathing slightly over vent

No corneal or gag reflexes

Conclusion

Police have missing person report 48 hours later

Hx Schizophrenia, HLD

Identity confirmed by family

Withdraws care

Pronounced

“[We] gave the family a chance to say goodbye.”

Dr. Nick Vizzuso

03

Refractory Ventricular Fibrillation Defined

“Refractory VF, pragmatically defined as a shockable presenting rhythm that is still observed after three shocks and associated 2-minute CPR cycles” - AHA

Approximately 300,000 out-of-hospital cardiac arrests annually

Vfib first rhythm in about 50,000

04

What is DSD?

Defined: “…the technique of providing two rapid shocks from two defibrillators with pads placed in the anterior-lateral and anterior-posterior position.”

04

Defib Pad Placement

Four is a crowd: Dual Dose Defibrillation

Two defibrillators deliver *simultaneous* shocks.

Less commonly practiced.

Concerns of myocardial injury, defib damage (0.4% in 1130 uses)

Voids defib warranty

Caution!

Ensure pads not touching

Don’t cross the cables

Caution!

Considered “off-label” use of defibrillator

Manufacturers of defib prohibited by law in recommending DSD

Do not delay high-quality CPR

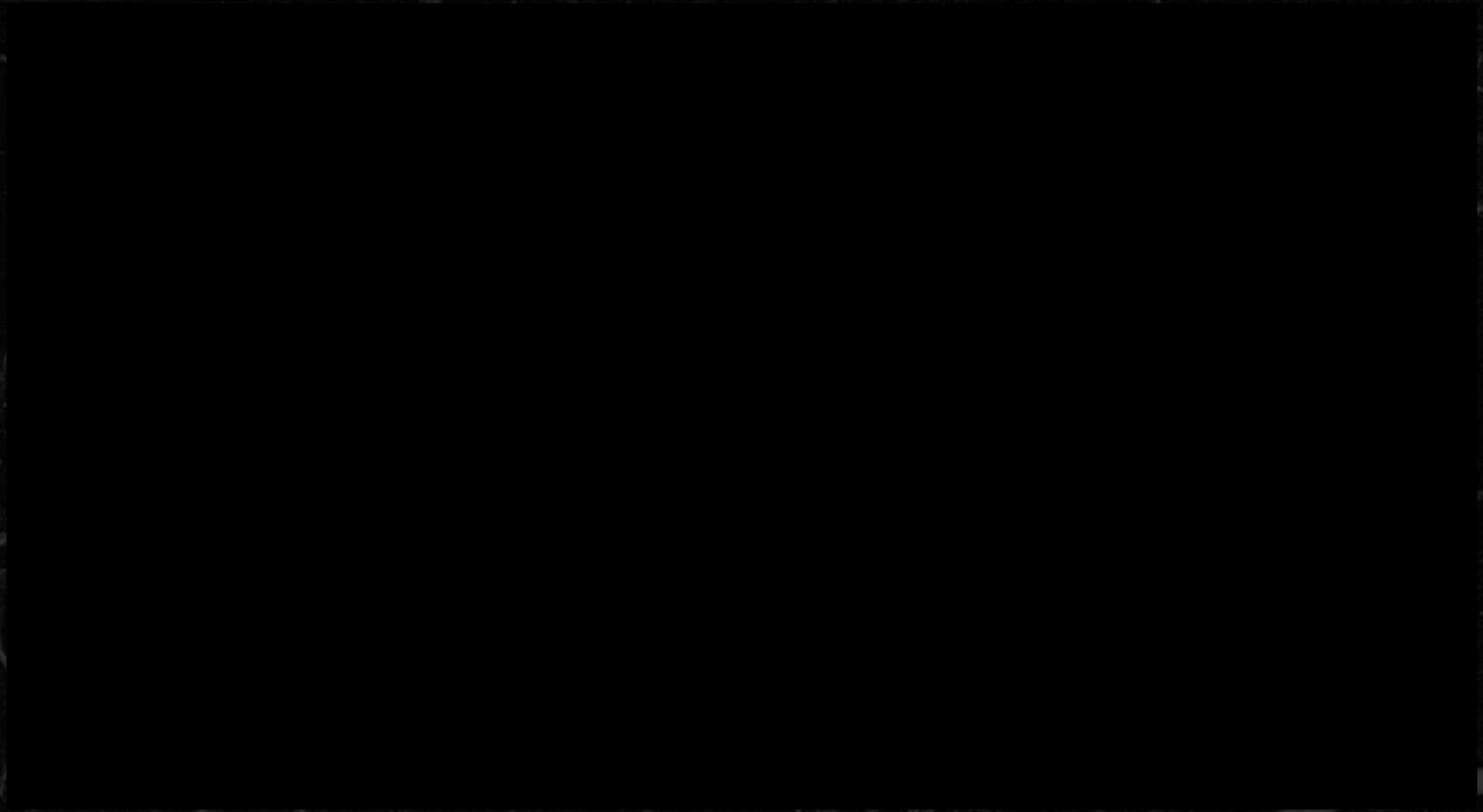
05

Procedure

No different than any other cardiac arrest!

One person charges and defibrillates in quick sequential order

Or…



05

The Research

AHA 2025 Guidelines:

“The usefulness of vector change (VC) and double sequential defibrillation (DSD) has not been established as therapies for shock-refractory ventricular fibrillation (VF); however, further investigation of these techniques, patient candidacy, and the development of new technology to optimize shock delivery are necessary.”

November 8, 2023, International Liaison Committee on Resuscitation Consensus on Science with Treatment Recommendations states:

We suggest that a [DSED] strategy (weak recommendation, low-certainty evidence) or a VC defibrillation strategy (weak recommendation, very low certainty evidence) may be considered for adults with cardiac arrest who remain in VF or pulseless ventricular tachycardia after ≥3 consecutive shocks. If a [DSED] strategy is used, we suggest an approach similar to that in the available trial, with a single operator activating the defibrillators in sequence (good practice statement).

Defibrillation Strategies for Refractory Ventricular Fibrillation (DOSE VF RCT) - New England Journal of Medicine.

Published November 2022

Study period: March 2018 - May 2020

Ended early due to pandemic

Six paramedic services in Ontario, Canada

405 patients enrolled

Compared:

Standard defibrillation

Vector change defibrillation (VC)

Dual Sequence Defibrillation (DSD)

Excluded traumatic arrest, DNR

Mean age: 63.6 years

84.4% were men

58% bystander CPR

Primary outcome:

Survival to hospital discharge.

Secondary outcomes:

Termination of VF,

ROSC with discharge in good neurologic outcome (Modified Rankin Score < 2)

Outcome	Standard	Vector Change	Dual Sequence
Total Patients	136 (33.6%)	125 (30.9%)	144 (35.6%)
Termination VF	92 (67.6%)	115 (79.9%)	105 (84%)
ROSC	36 (26.5%)	51 (35.4%)	58 (46.4%)
Survival to discharge	18 (13.3%)	31 (21.7%)	38 (30.4%)
Survival with good outcome	15 (11.2%)	23 (16.2%)	34 (27.4%)

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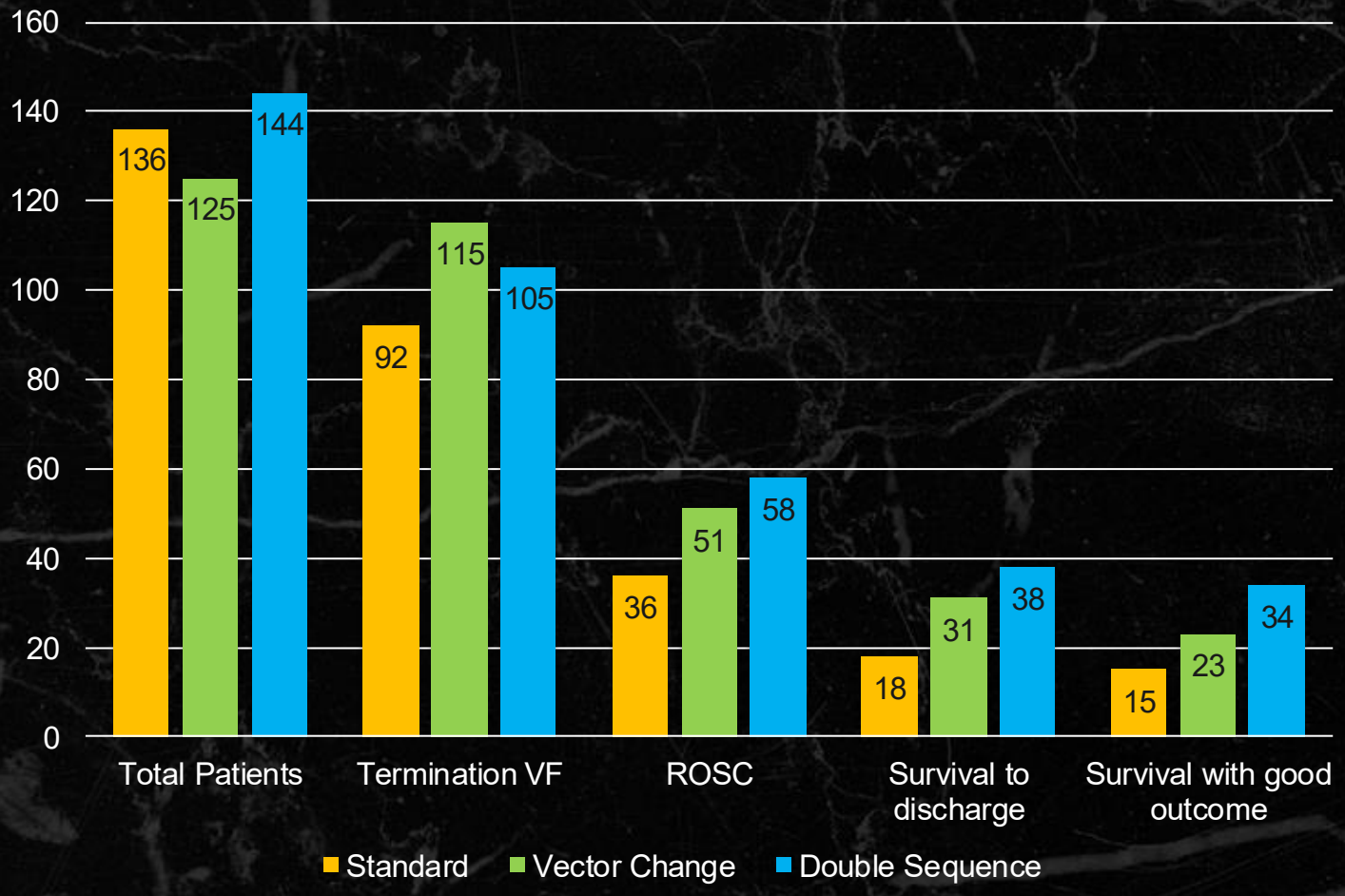
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Survival with good outcome
Standard
Vector Change
Double Sequence

Other Data	Standard	Vector Change	Dual Sequence
Bystander Witness Cardiac Arrest	82 (60.3%)	110 (76.4%)	83 (66.4%)
Bystander CPR Performed	74 (54.4%)	90 (62.5%)	71 (56.8%)
Median Response Time	7.4 min	7.4 min	7.8 min
Median time from initial call to first shock	10.2 min	10.4 min	10.2 min
Number shocks to first ROSC	5.5	5.3	5.7

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Study: “The impact of alternate defibrillation strategies on shock-refractory and recurrent ventricular fibrillation: a secondary analysis of the DOSE VF cluster randomized controlled trial. ”

Same authors of DOSE VF RCT

Took original data and now examined outcomes of recurrent VF, versus true shock-refractory vfib

Recurrent VF defined as absence of VF for at least five seconds followed by recurrence of VF

Shock-refractory VF defined as continuous VF before and after three shocks

Outcome analysis same as original study

345 of original 405 patients included

60 (17%) shock-refractory

285 (83%) recurrent VF

DSD showed significantly better outcomes than standard or VC defibrillation, especially in *true refractory* VF

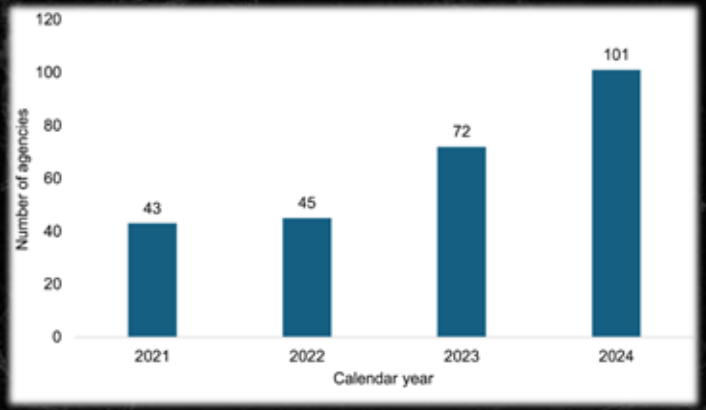
VF termination rates were similar across all strategies in shock-refractory VF

VC and DSD outperformed standard defibrillation in recurrent VF

DSD superior overall, with VC a reasonable alternative

Since publication of DOSE-VF,

EMS agencies increasingly performing DSD



06

How Does DSD Work?

Power Hypothesis:

Two sequential shocks may deliver a combined energy that a single shock can’t achieve.”

Priming Theory:

First shock may lower myocardial resistance, allowing the second to more effectively depolarize myocardium (one-two-punch)

Multi-Vector Theory:

Dual pad positions apply energy through different planes, increasing the chance of disrupting reentrant circuits in VF.

Improved Myocardial Engagement:

Captures more heart muscle and may bypass directional resistance caused by myocardial injury

07

Why This Lecture?

Refractory VF is rare, but real

- Incidence - 0.5 to 0.6 per 100,000
- Mortality of up to 97%

Perfect Hail Mary!

“Under pressure, you don’t rise to the occasion;
you sink to the level of your training.”

Greek Poet Archilochus & Navy SEAL Mantra

Teamwork

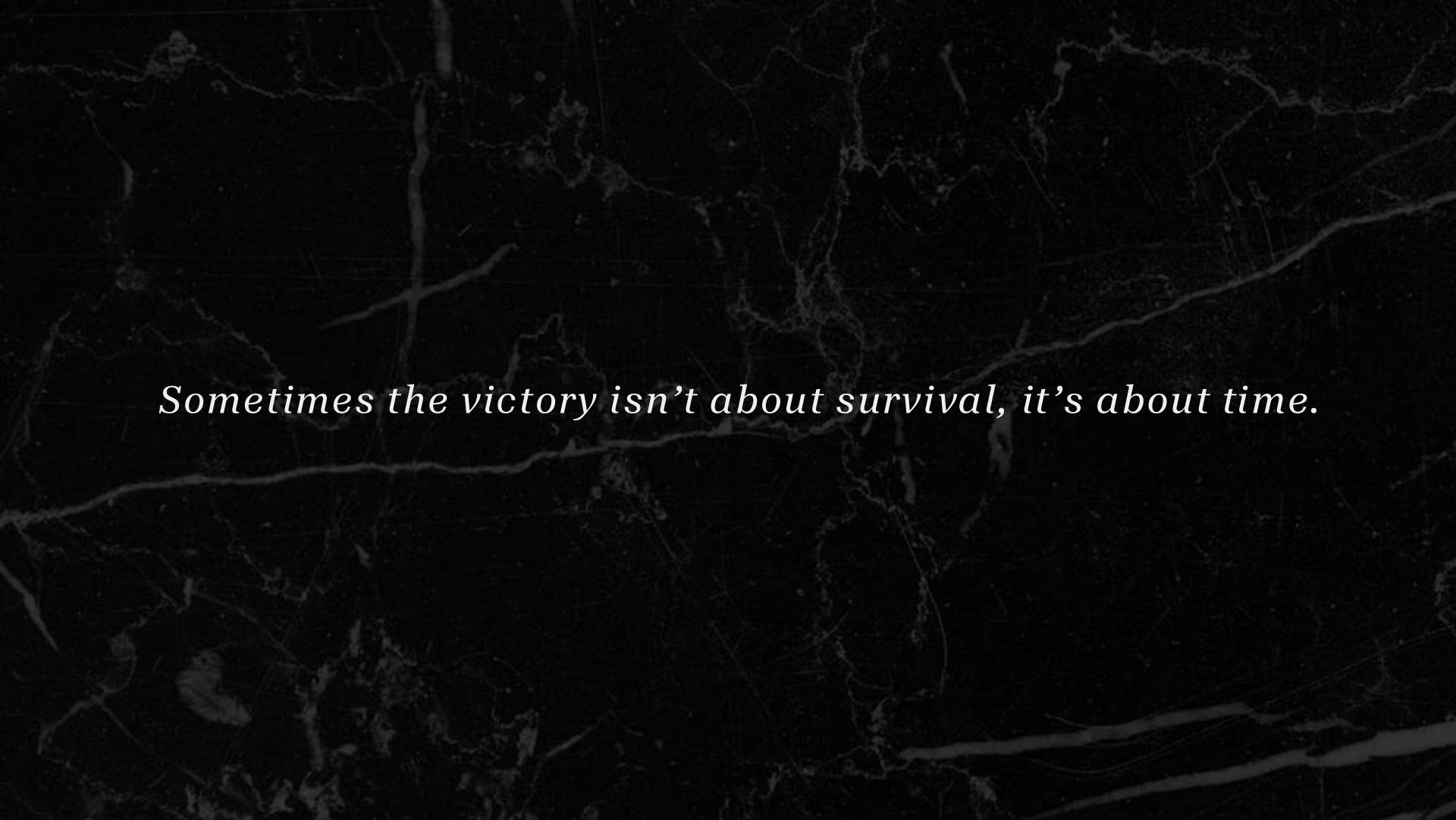
Nurses have a voice – use it!

Keep updated and an open mind on the current literature

EBP can prove and disprove a theory simultaneously.

“[We] gave the family a chance to say goodbye.”

Dr. Nick Vizzuso


Sometimes the victory isn’t about survival, it’s about time.

Sebastian teaches CPR 2005 (2.5 years old)

2026: Mackenna wins 1st place for most money raised for AHA

Contact: GhostRiderRN@proton.me

08

References

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Slide 5 (video): https://www.youtube.com/watch?v=BKP3Qe_zZ18

Slide 14 (video): https://www.youtube.com/watch?v=5sxRGSFEP30

Slide 23 (picture): 1947 Defibrillator. (n.d.). https://commons.wikimedia.org/wiki/File:1947_defibrillator.jpg#Summary.

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Slide 49: Cheskes, S., Drennan, I. R., Turner, L., Pandit, S. V., & Dorian, P. (2024). The impact of alternate defibrillation strategies on shock-refractory and recurrent ventricular fibrillation: A secondary analysis of the DOSE VF cluster randomized controlled trial. Resuscitation, 198, 110186. https://doi.org/10.1016/j.resuscitation.2024.110186

Slide 49: Cheskes, S., Drennan, I. R., Turner, L., Pandit, S. V., & Dorian, P. (2024). The impact of alternate defibrillation strategies on shock-refractory and recurrent ventricular fibrillation: A secondary analysis of the DOSE VF cluster randomized controlled trial. Resuscitation, 198, 110186. https://doi.org/10.1016/j.resuscitation.2024.110186

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Additional Reading

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