
# ABC's or CAB's: What's New in the AHA Resuscitation Guidelines?

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# Learning Outcomes

- Discuss important updates in the 2015 AHA resuscitation guidelines and the literature supporting or refuting various aspects of emergency management and their impact on clinical outcomes.

# What's New?

- Focus on compression fraction
  - Rate 100-120 per minute
  - Compression depth 5-6 cm
- Capnography recommendations
- Medication update
  - Vasopressin removed
  - Lidocaine not *routinely* recommended
  - Epinephrine continues to disappoint
  - Naloxone added for suspected opiate overdose
- Additional Strategies

American Heart Association. H I G H L I G H T S of the 2015 American Heart Association Guidelines Update for CPR and ECC. www.heart.org/cpr accessed April 22, 2016

## Question #1
## The compression fraction can be increased during CPR by:

a) Increasing the rate and depth of compressions
b) Increasing the rate and decreasing the depth of compressions
c) Increasing the rate and decreasing interruptions to compressions
d) Increasing the depth of compressions and decreasing interruptions to compressions

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# Resuscitation Practices Associated with Survival

- Arrest survival correlated with GWTG survey responses regarding resuscitation practices
- 131 hospitals: hospital survival rates 9.2% – 37.5%
- Three strategies associated with increased survival
  - monitor for compression interruptions during CPR (2X)
  - arrest cases reviewed monthly (6X)
  - adequate resuscitation training reported by staff (3X)

Chan PS, Krein SL, Tang F, et al. JAMA Cardiol. April 6, 2016.
doi:10.1001/jamacardio.2016.0073

# Compressions & High Quality CPR

- Number of compressions delivered is an important determinant of survival after arrest
- Affected by *both* rate and interruptions
- Compression fraction = portion of total CPR time when compressions are performed; goal > 60%
- Optimize by:
  - Increasing rate of compressions (↑ to 120)
  - Reducing interruptions (frequency and duration)
  - Upper limits for both added in 2015

American Heart Association. H I G H L I G H T S of the 2015 American Heart Association Guidelines Update for CPR and ECC. www.heart.org/cpr accessed April 22, 2016

# Compressions & High Quality CPR

American Heart Association
life is why™
GUIDELINES 2015 CPR & ECC

## Sequence of Interventions Remains C-A-B

**Table 1** BLS Dos and Don'ts of Adult High-Quality CPR

| Rescuers Should | Rescuers Should *Not* |
|---|---|
| Perform chest compressions at a rate of 100-120/min | Compress at a rate slower than 100/min or faster than 120/min |
| Compress to a depth of at least 2 inches (5 cm) | Compress to a depth of less than 2 inches (5 cm) or greater than 2.4 inches (6 cm) |
| Allow full recoil after each compression | Lean on the chest between compressions |
| Minimize pauses in compressions | Interrupt compressions for greater than 10 seconds |
| Ventilate adequately (2 breaths after 30 compressions, each breath delivered over 1 second, each causing chest rise) | Provide excessive ventilation (ie, too many breaths or breaths with excessive force) |

American Heart Association

American Heart Association. H I G H L I G H T S of the 2015 American Heart Association Guidelines Update for CPR and ECC. www.heart.org/cpr accessed April 22, 2016

# Capnography


- Physiologic parameters provide valuable information regarding response to therapy (e.g., $ETCO_2$, CPP, arterial BP, etc.).
- Favor strategies that offer continuous monitoring without interrupting compressions.
- $ETCO_2$ remains Class 1 recommendation to confirm intubation; use for prognostication with other factors.

***2015 Recommendations—Updated***

Continuous waveform capnography is recommended in addition to clinical assessment as the most reliable method of confirming and monitoring correct placement of an ETT (Class I, LOE C-LD).

***2015 Recommendations—New***

In intubated patients, failure to achieve an $ETCO_2$ of greater than 10 mm Hg by waveform capnography after 20 minutes of CPR may be considered as one component of a multimodal approach to decide when to end resuscitative efforts, but it should not be used in isolation (Class IIb, LOE C-LD).

## Question #2

CPR is in progress for cardiac arrest when the capnography waveform below is noted. What does this indicate?


a) CPR is not adequate for perfusion.
b) The sudden increase indicates return of spontaneous circulation (ROSC).
c) Compressions are too deep, causing artifact.
d) This patient will not recover.

Question #2

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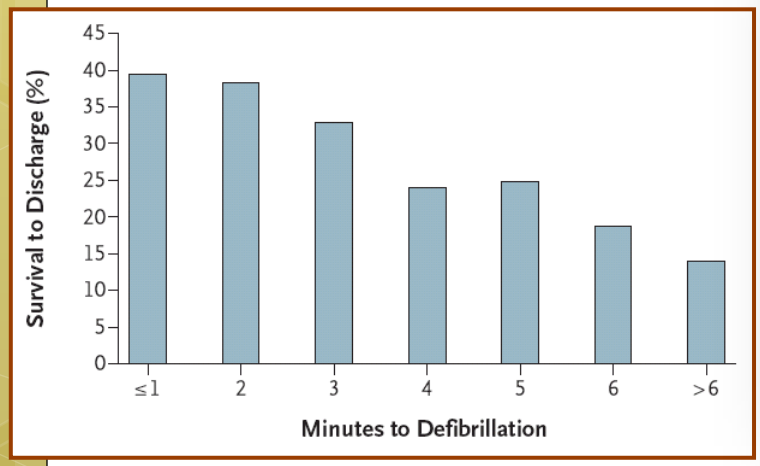
# Capnography & CPR Quality

- Eliminate pulse checks!
  - Palpation for a pulse is an insensitive indicator of organ perfusion with very poor inter-rater reliability
- Utilize $ETCO_2$ to assess perfusion and treatment response.
  - Assess CPR adequacy; $ETCO_2$ goal = 12-15 mmHg
  - $ETCO_2$ < 10 mmHg may indicate poor CPR quality
  - $ETCO_2$ spike to 35-40 mmHg confirms ROSC
    - Recommend continued CPR until perfusion established

Helman A. Emergency medicine cases. Episode 71 ACLS Guidelines 2015 – Cardiac arrest controversies, Part 1. http://emergencymedicinecases.com/acls-guidelines-2015-cardiac-arrest/ accessed April 22, 2016

# Electrical Therapy for VF

- Early defibrillation is critical to survival.
  - Guidelines recommend defibrillation within 2 minutes.
  - Defibrillation exceeds 2 minutes in 30% of inpatients.
  - Survival rates are 17% lower with delayed defibrillation (22.2% vs 39.3%).




| End Point | ≤2 Minutes to Defibrillation (N = 4744) | >2 Minutes to Defibrillation (N = 2045) |
|---|---|---|
| Survival outcomes — no./total no. (%) | | |
| Return of spontaneous circulation | 3165/4744 (66.7) | 1003/2045 (49.0) |
| Survival to 24 hr | 2607/4744 (55.0) | 765/2045 (37.4) |
| Survival to discharge | 1863/4744 (39.3) | 455/2045 (22.2) |
| Neurologic outcomes — no./total no. (%)‡ | | |
| No major disability | 931/1549 (60.1) | 197/381 (51.7) |
| Moderate disability | 437/1549 (28.2) | 134/381 (35.2) |
| Severe disability | 152/1549 (9.8) | 36/381 (9.4) |
| Coma or vegetative state | 29/1549 (1.9) | 14/381 (3.7) |

Chan PS, et al. *NEJM* 2008;358(1):9-17

# Timing of Defibrillation

## Shock First vs CPR First

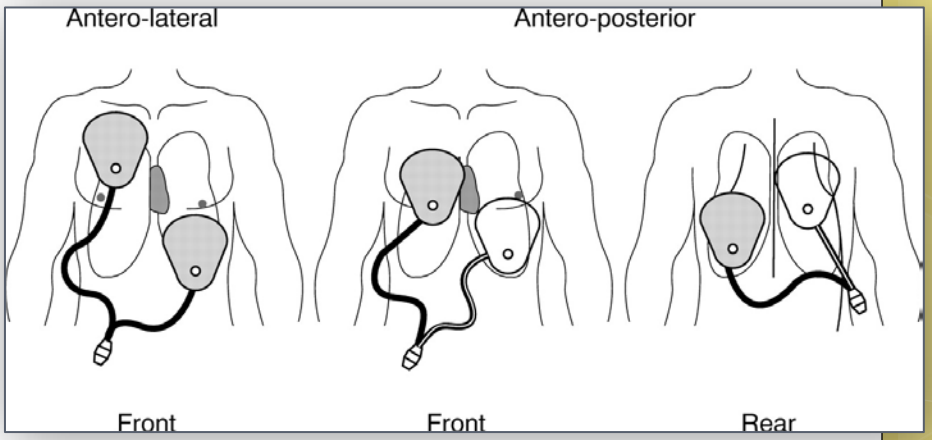
**2015 (Updated):** For witnessed adult cardiac arrest when an AED is immediately available, it is reasonable that the defibrillator be used as soon as possible.

- Numerous studies have identified no benefit to a brief period (1 ½ - 3 min) of compressions prior to defibrillation, for witnessed arrest

American Heart Association. H I G H L I G H T S of the 2015 American Heart Association Guidelines Update for CPR and ECC. www.heart.org/cpr accessed April 22, 2016

# Reducing Time to Defibrillation

- Defibrillator readily available and standardized
- Optimal use of hands free defibrillator pads




- Non-code team members can defibrillate

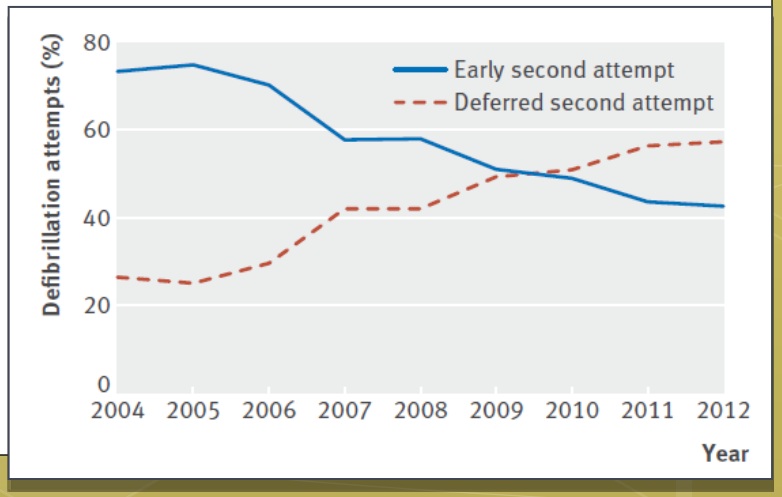
☑ For pulseless VT/VF, if defibrillator available

Post-op, Routine, CONTINUOUS starting Today at 0815 Until Specified
What is the nursing communication order: For pulseless VT/VF, if defibrillator available
For pulseless VT/VF, if defibrillator available, certified RN to provide 3 stacked shocks at 200J with biphasic defibrillator prior to initiating CPR. Fine VF should be considered if rhythm appears to be asystole, Sign & Hold

No AHA change in 2015!

# 2016 UPDATE: Single vs Stacked Shocks

- In 2005, AHA guidelines changed from 3 successive shocks to a single shock → CPR, per OHCA data
- Retrospective review of GWTG hospitals (IHCA, n=172)
  - Adults who received a 2nd shock for VF/pVT within 3 min
  - Compared early 2nd shock (≤ 1 min) vs deferred (> 1 min)
- Compliance: from 2004 to 2012 more 2nd shocks were deferred (>1 min) per AHA guidelines
  - Increased from 26% to 57%
- How did this impact survival?




Bradley SM, Liu W, Chan PS, et al. BMJ 2016; 353:i1653. doi:10:1136/bmj.i1653

# Results of Delayed 2nd Shock

- Delayed 2nd shock associated with *worse outcomes*

Table 2 | Survival and neurologic outcomes by time interval between defibrillation attempts

| | No (%) with second defibrillation attempt | | Risk ratio (95% CI) |
|---|---|---|---|
| Outcome | Early | Deferred | Unadjusted |
| **Survival outcomes** | | | |
| Return of spontaneous circulation | 1008/1612 (62.5) | 643/1121 (57.4) | 0.92 (0.86 to 0.98) |
| Survival to 24 hours | 701/1606 (43.6) | 430/1121 (38.4) | 0.88 (0.80 to 0.96) |
| Survival to discharge | 495/1605 (30.8) | 277/1121 (24.7) | 0.80 (0.71 to 0.91) |
| **Neurologic outcome (survivors only)** | | | |
| No major disability | 306/443 (69.1) | 152/236 (64.4) | 0.93 (0.83 to 1.04) |

- "…greater emphasis on rhythm termination for persistent VF/pVT might be warranted in hospital."

Bradley SM, Liu W, Chan PS, et al. BMJ 2016;353:i1653. doi:10:1136/bmj.i1653

# Single vs Stacked Shock Protocol

- Single center retrospective observational study of three historical resuscitation protocols
- 3 SS → single shock & 2 min CPR → 3 SS (120j-150j - 200j) if witnessed
- Highest survival with modified 3 SS protocol

"Our data suggest that in cases of monitored VF/VT arrest, expeditious defibrillation with use of stacked shocks is associated with a higher rate of ROSC and survival to hospital discharge."

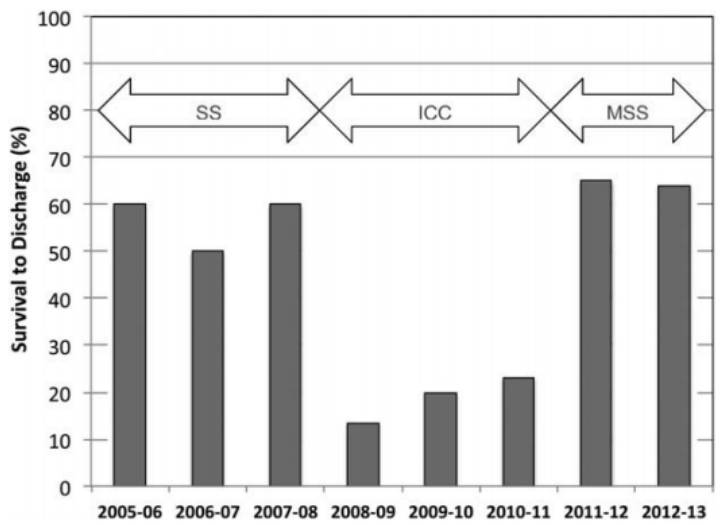



**FIG. 1.** Survival to discharge for patients with ventricular fibrillation/ventricular tachycardia arrest from 2005 to 2013. Survival was significantly lower during the initial chest compression (ICC) period as compared to stacked shocks (SS) and modified stacked shock (MSS) periods ($P < 0.01$).

Davis D, Aguila SA, Sell R, et al. J Hosp Med 2016;11(4):264-268

# Recommendations Regarding 3 Shock Protocol

- For refractory VF/pVT in witnessed IHCA, recent data supports use of a 3-shock strategy
- STS Consensus Statement for arrest after cardiac surgery recommends 3 sequential shocks
- 2010 ERC guidelines now recommend 3 sequential attempts at defibrillation for witnessed VF/pVT arrest 'where immediate defibrillation is available'
- "it is unlikely that chest compressions will improve the already very high chance of return of spontaneous circulation when defibrillation occurs early in the electrical phase, immediately after onset of VF"
- *This is currently <u>not recommended</u> in the AHA guideline*

Soar J, et al. ERC Guidelines for Resuscitation. Cardiac arrest in special circumstances. *Resuscitation* 2010; 81:1400-1433.

# Medication Update

What's in, what's out . . .

KISS . . . simplify

## Question #3
## Important 2015 changes to medication recommendations for cardiac arrest include:

a) Removal of vasopressin and lidocaine from the algorithm
b) Removal of epinephrine from the algorithm
c) Favor high dose epinephrine
d) Favor high dose vasopressin

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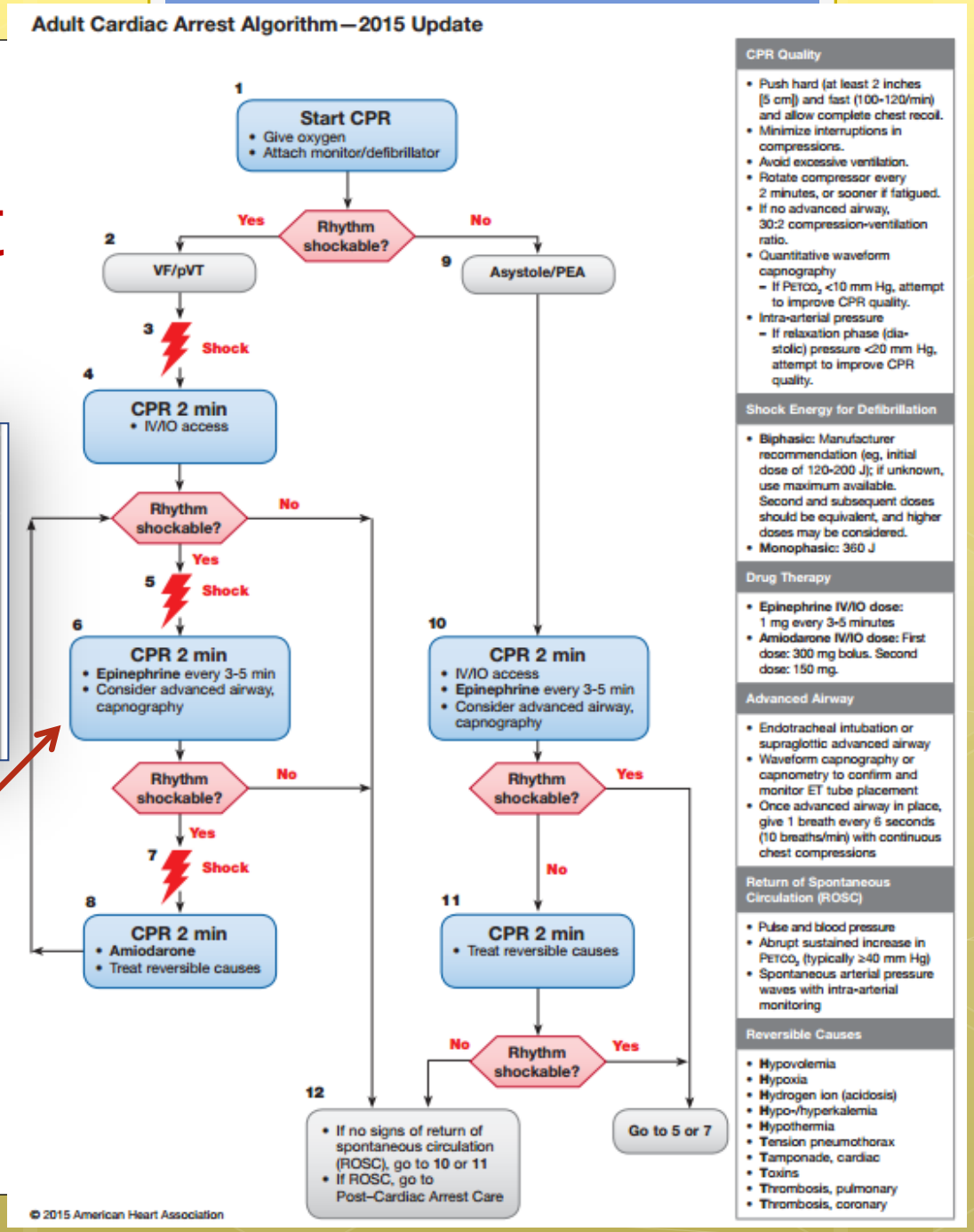
# Drugs for Cardiac Arrest

## Drug Therapy

- **Epinephrine IV/IO dose:** 1 mg every 3-5 minutes
- **Amiodarone IV/IO dose:** First dose: 300 mg bolus. Second dose: 150 mg.

Epinephrine recommended after 2nd failed shock

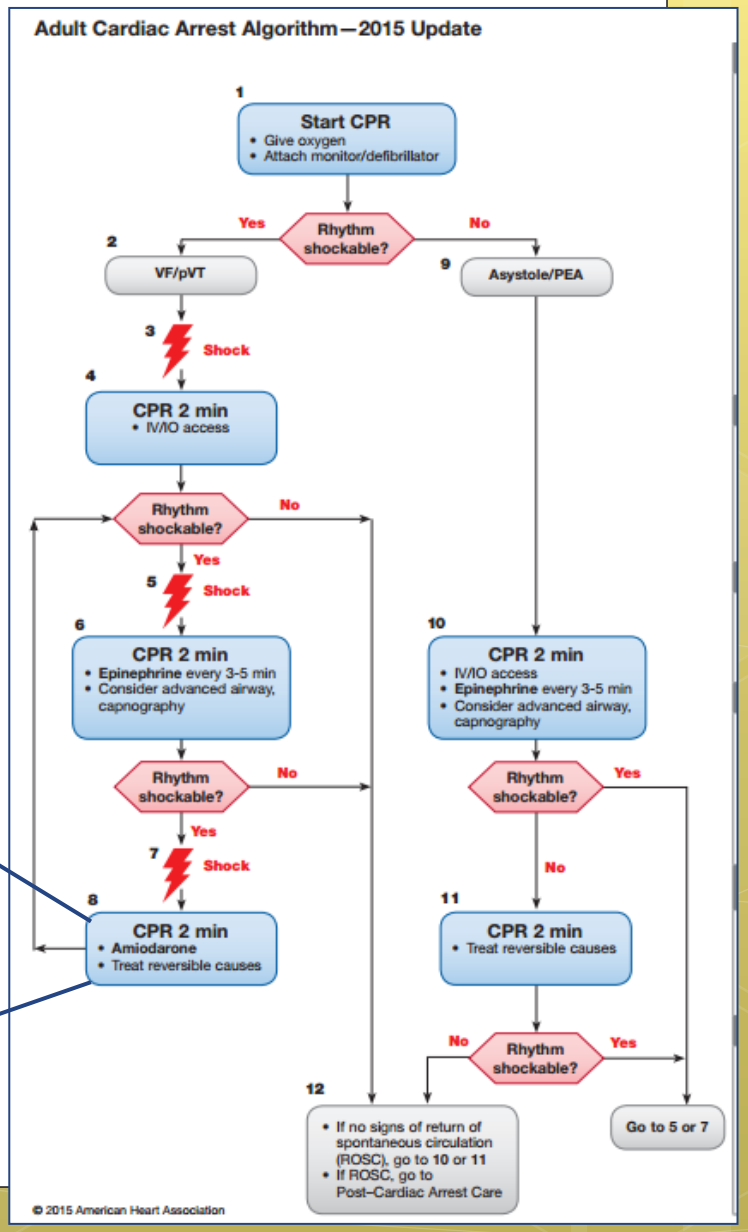


# Limits on Lidocaine

## Post–Cardiac Arrest Drug Therapy: Lidocaine

**2015 (New):** There is inadequate evidence to support the routine use of lidocaine after cardiac arrest. However, the initiation or continuation of lidocaine may be considered immediately after ROSC from cardiac arrest due to VF/pVT.

**CPR 2 min**
- **Amiodarone**
- Treat reversible causes



# Why? The ALPS

- The **A**miodarone, **L**idocaine, or **P**lacebo **S**tudy
- Multicenter RCT; 3026 pts randomly assigned to 1 of 3 treatment groups by EMS (out of hospital)
- Enrolled after at least one failed shock for VF/pVT
- Results: no significant difference in survival or neurologic recovery between the 3 groups

**Table 3. Outcomes According to Trial Group in the Per-Protocol Population.***

| Outcome | Amiodarone (N=974) | Lidocaine (N=993) | Placebo (N=1059) |
|---|---|---|---|
| Primary outcome: survival to discharge — no./total no. (%)† | 237/970 (24.4) | 233/985 (23.7) | 222/1056 (21.0) |
| Secondary outcome: modified Rankin score ≤3 — no./total no. (%)‡ | 182/967 (18.8) | 172/984 (17.5) | 175/1055 (16.6) |

Kudenchuk PJ, Brown SP, Daya M, et al. NEJM.org, April 4, 2016 **DOI: 10.1056/NEJMoa1514204**.

# Important Differences if Witnessed

"If you give these drugs to somebody who has shock-refractory VF, you'll do no harm to someone who can't be saved. But to the majority, the witnessed group, you'll improve their survival substantially." Peter Kudenchuk MD

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Witnessed status** | | | | | | | 0.05 |
| EMS witnessed, n (%) [N=57;43;54] | 22 (38.6%) | 10 (23.3%) | 9 (16.7%) | 21.9% | 6.6% | 15.3% | |
| | | | | (5.8%, 38.0%) | (-9.5%, 22.7%) | (-2.6%, 33.2%) | |
| | | | | P=0.01 | P=0.42 | P=0.09 | |
| Bystander witnessed, n (%) [N=618;632;684] | 171 (27.7%) | 176 (27.8%) | 155 (22.7%) | 5.0% | 5.2% | -0.1% | |
| | | | | (0.3%, 9.7%) | (0.5%, 9.9%) | (-5.1%, 4.9%) | |
| | | | | P=0.04 | P=0.03 | P=0.97 | |
| Unwitnessed, n (%) [N=271;282;286] | 41 (15.1%) | 45 (16.0%) | 48 (16.8%) | -1.7% | -0.8 | -0.9% | |
| | | | | (-7.8%, 4.4%) | (-6.9%, 5.3%) | (-6.9%, 5.1%) | |
| | | | | P=0.58 | P=0.80 | P=0.77 | |

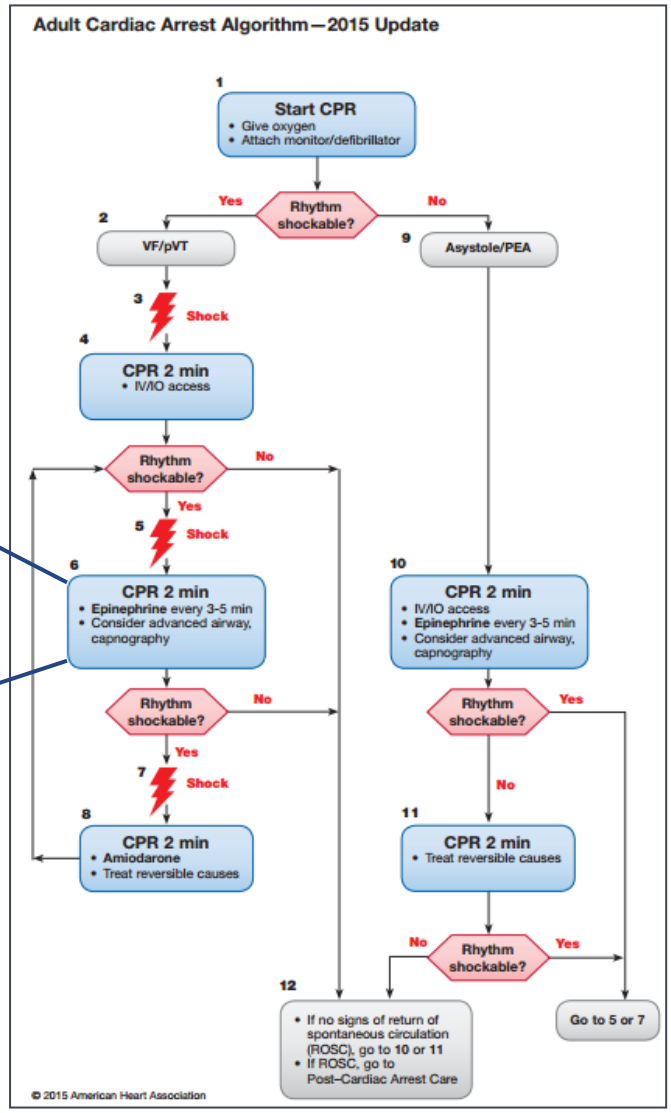
Kudenchuk PJ, Brown SP, Daya M, et al. NEJM.org, April 4, 2016 **DOI: 10.1056/NEJMoa1514204**.

# Bye Bye Vasopressin

## Vasopressors for Resuscitation: Vasopressin

**2015 (Updated):** Vasopressin in combination with epinephrine offers no advantage as a substitute for standard-dose epinephrine in cardiac arrest.

**CPR 2 min**
- **Epinephrine** every 3-5 min
- Consider advanced airway, capnography




American Heart Association. H I G H L I G H T S of the 2015 American Heart Association Guidelines Update for CPR and ECC. www.heart.org/cpr accessed April 22, 2016

# The Rationale

- Important note ....

> No antiarrhythmic drug has yet been shown to increase survival or neurologic outcome after cardiac arrest due to VF/pVT. Accordingly, recommendations for the use of antiarrhythmic medications in cardiac arrest are based primarily on the potential for benefit on short-term outcome until more definitive studies are performed to address their effect on survival and neurologic outcome.

- Recommendation based on two new studies showing lack of clear benefit, not harm
- No benefit demonstrated for OHCA with VF/pVT
- Single study showed *possible* role in IHCA "bundle" combined with epi and steroids

*Circulation* 2015;132[suppl 2]:S444–S464. DOI: 10.1161/CIR.0000000000000261

RESUSCITATION
OFFICIAL JOURNAL OF THE EUROPEAN RESUSCITATION COUNCIL
European Resuscitation Council

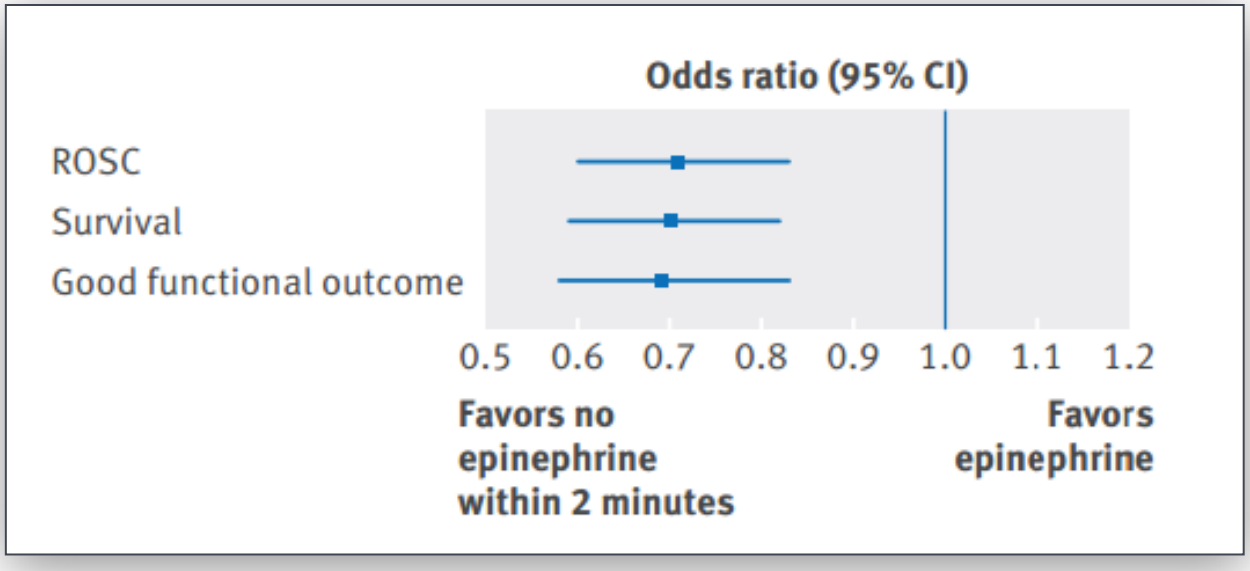
Reduced effectiveness of vasopressin in repeated doses for patients undergoing prolonged cardiopulmonary resuscitation☆

- Prospective RCT comparing up to four injections of epinephrine 1mg (n=118) or vasopressin 40 IU (n=137) for refractory VF/pVT in the ED
- No difference in ROSC (epi 26.6% vs vaso 28.7%) or survival to discharge (epi 3.8% vs vaso 5.6%)
- In witnessed arrest group: vaso demonstrated higher ROSC (48.1% vs 27.8%) but no difference in survival (OR 0.87-0.28)

Mukoyama T, Kinoshita K, Nagao K, Tanjoh K. 2009; 80 (7):755–761

# Epinephrine for VF/pVT

- Multicenter RCT evaluating outcomes when epi given ≤ 2 minutes of first defibrillation failure
- 2978 patients matched using propensity scores
- Epinephrine associated with worse outcomes




Andersen LW, Kurth T, Chase M, et al. BMJ 2016;353:i1577 doi:10.1136/bmj.i1577

# Epinephrine

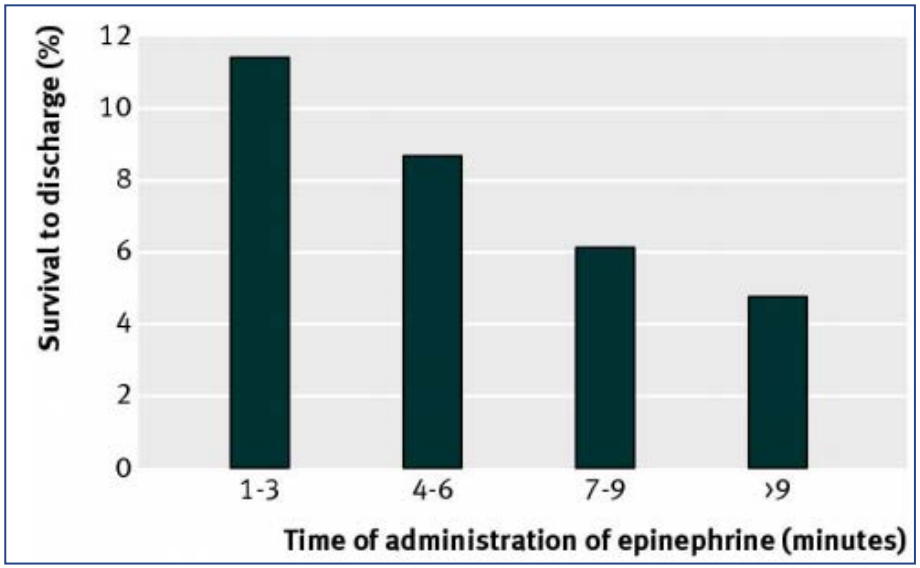
"Whilst the jury remains out on the overall safety or effectiveness of adrenaline in cardiac arrest, these data suggest that if adrenaline is given, it should be deferred until at least after the 2nd shock has been delivered."

Dr. Gavin Perkins, University of Warwick, Coventry, UK

Mixed Effects of Resuscitation Guidelines for In-Hospital Cardiac Arrest. *Medscape*. April 14, 2016

# Epinephrine in Non-Shockable Rhythms

- Improved survival in 3 OHCA trials* (2 large RCT) when epi given within 9-10 minutes of CPR
- Improved neurologically intact survival in 1 IHCA trial† (n=25,095) with early initiation of epinephrine




† Donnino MW, et al *BMJ.* 2014;348:g3028


* Goto Y, et al. *Crit Care.* 2013;17:R188. doi: 10:1186/cc12872.
* Nakahara S, et al. *Acad Emerg Med.* 2012;19:782-792.
* Koscik C, et al. *Resuscitation.* 2013;84:915-920.

# High Dose Epinephrine

***2015 Evidence Summary***

A number of trials have compared outcomes from standard-dose epinephrine with those of high-dose epinephrine. These trials did not demonstrate any benefit for high-dose epinephrine over standard-dose epinephrine for survival to discharge with a good neurologic recovery (ie, Cerebral Performance Category score),[116,117] survival to discharge,[116–120] or survival to hospital admission.[116–118,121] There was, however, a demonstrated ROSC advantage with high-dose epinephrine.[116–121]

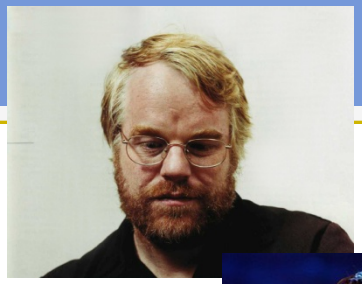
***2015 Recommendation—New***

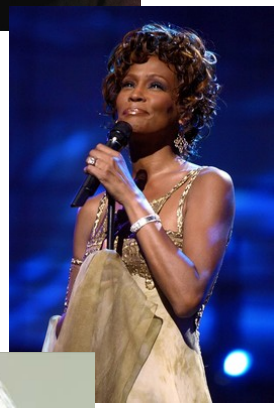
High-dose epinephrine is not recommended for routine use in cardiac arrest (Class III: No Benefit, LOE B-R).

# Summary of Epinephrine Data

- Controversy persists surrounding the optimal use of epinephrine for cardiac arrest.
- Current AHA guidelines call for *standard dose* epi after the 2nd failed shock, ERC after the 3rd shock.
- Neurologically intact survival has <u>not</u> been demonstrated for VF/pVT but was recently reported for non-shockable rhythms.
- For shockable rhythms
  - Use no earlier than 2nd failed shock in standard dose
- For non-shockable rhythms
  - Consider early administration

# The Opioid Epidemic





- 21.5 million Americans > age 12 have a substance abuse disorder – 1.9 million from prescription pain relievers.
- Drug overdose is now the leading cause of accidental death in the US.
  - 47,055 fatal OD in 2014: 18,893 from pain meds vs 10,574 from heroin
- Almost half a million adolescents use pain relievers and 168,000 were addicted to pain relievers in 2014.
- 48,000 women died of prescription drug overdose between 1999-2010.

American Society of Addiction Medicine. 2016 Opiod Addiction Facts & Figures. www.asam.org/docs/default-source/advocacy/opiod-addition-disease-facts-figures.pdf

# First Responders

## Opioid Overdose Treatment

**2015 (New):** Empiric administration of IM or IN naloxone to all unresponsive victims of possible opioid-associated life-threatening emergency may be reasonable as an adjunct to standard first aid and non-HCP BLS protocols.

BUSINESS INSIDER REUTERS

## The average bystander won't know how to control bleeding

Reuters
Apr. 19, 2016, 4:58 PM 16

The primary method to control bleeding is through the application of firm, direct pressure. When direct pressure is not effective for severe or life-threatening bleeding, the use of a hemostatic dressing combined with direct pressure may be considered but requires training in proper application and indications for use.

# Summary

- Shockable rhythms
  - Early defibrillation saves lives - shock without delay.
  - Consider stacked shocks for witnessed IHCA (per European guidelines, not AHA).
  - Amiodarone is the only recommended antiarrhythmic.
  - Epinephrine has no demonstrated survival benefit.
- Nonshockable rhythms
  - Epinephrine may be of benefit, if given early.
- Simplify arrest management to what works.
  - High quality CPR saves lives!!!
  - Capnography is our best monitor for ETT placement and ongoing response.