

Cardiac Arrest Update

*The Articles You've
Got to Know!!*

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For This Lecture...

- Where we are as of 2009
- Where we are going...
 - Focus on literature of past year

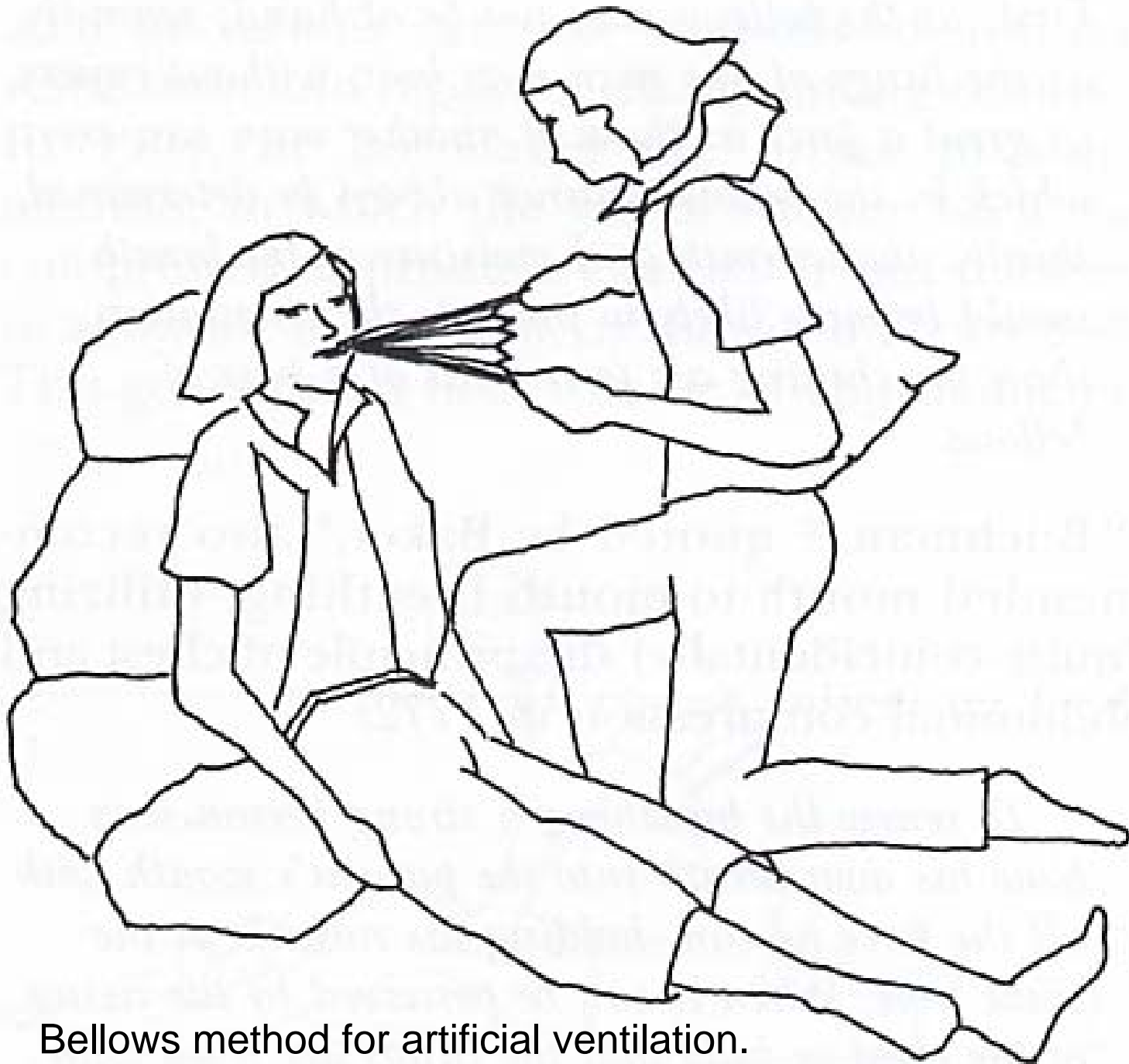


Cardiac Arrest









Bellows method for artificial ventilation.



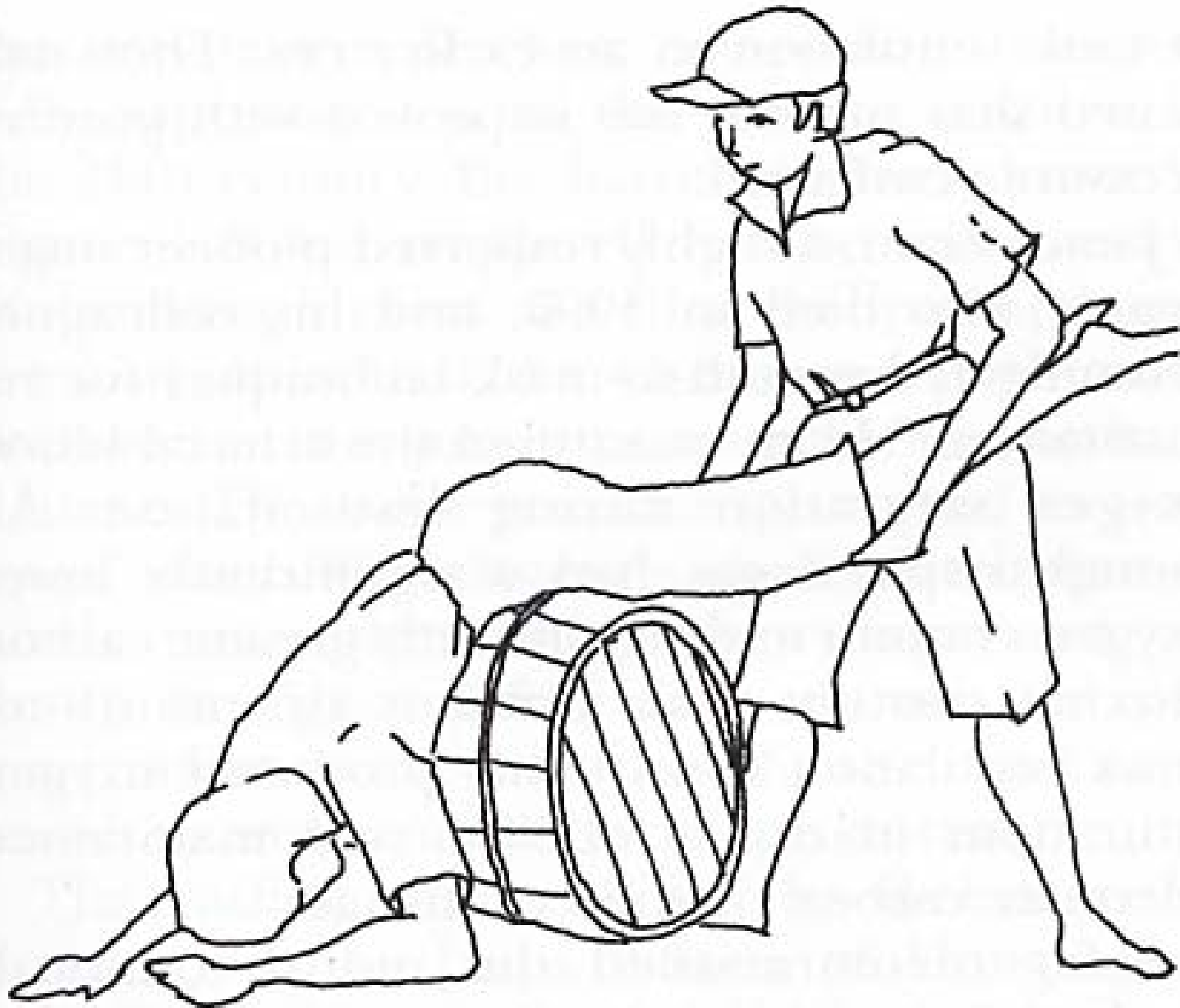
Marshall Hall's method



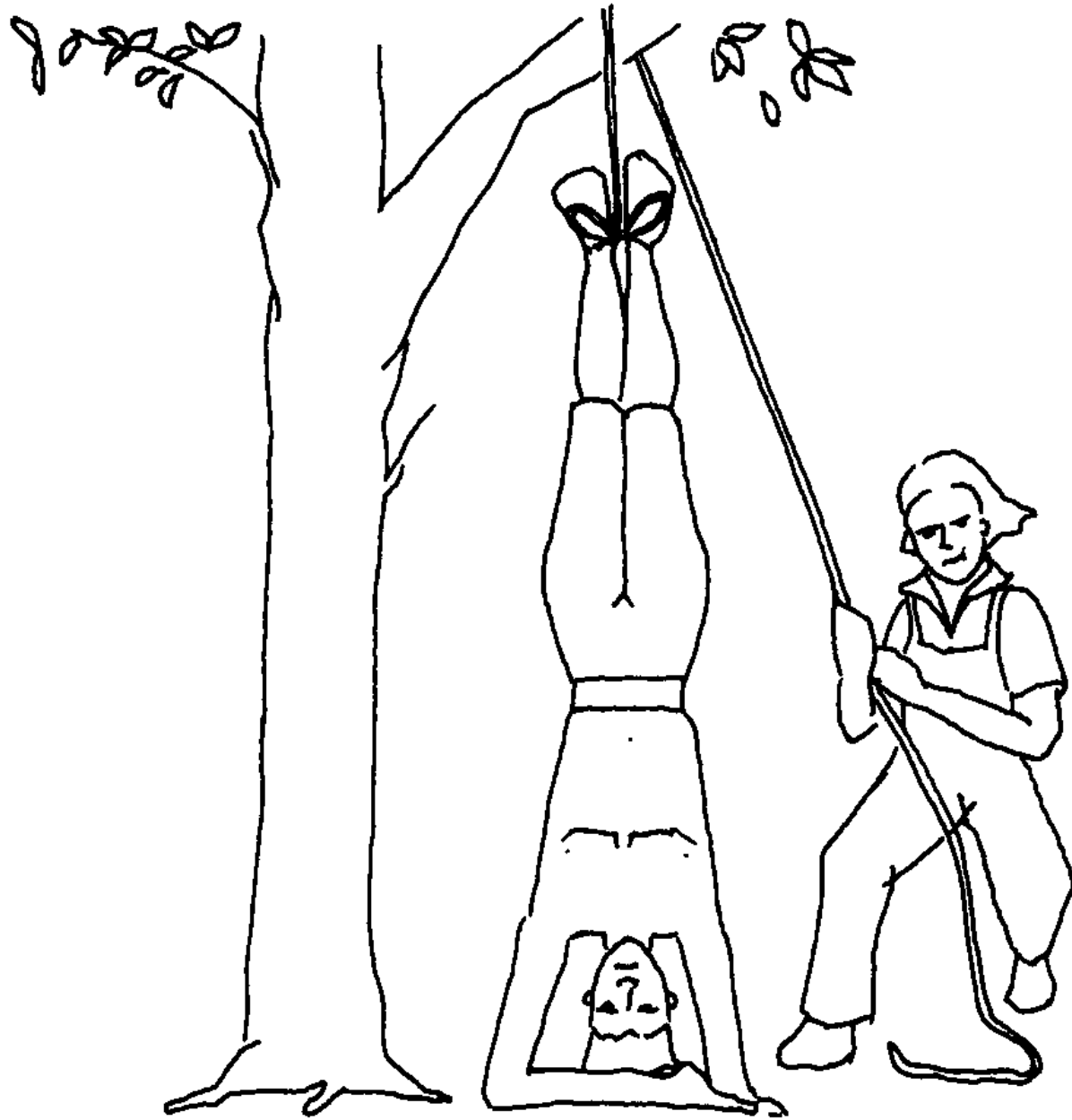
Howard's method



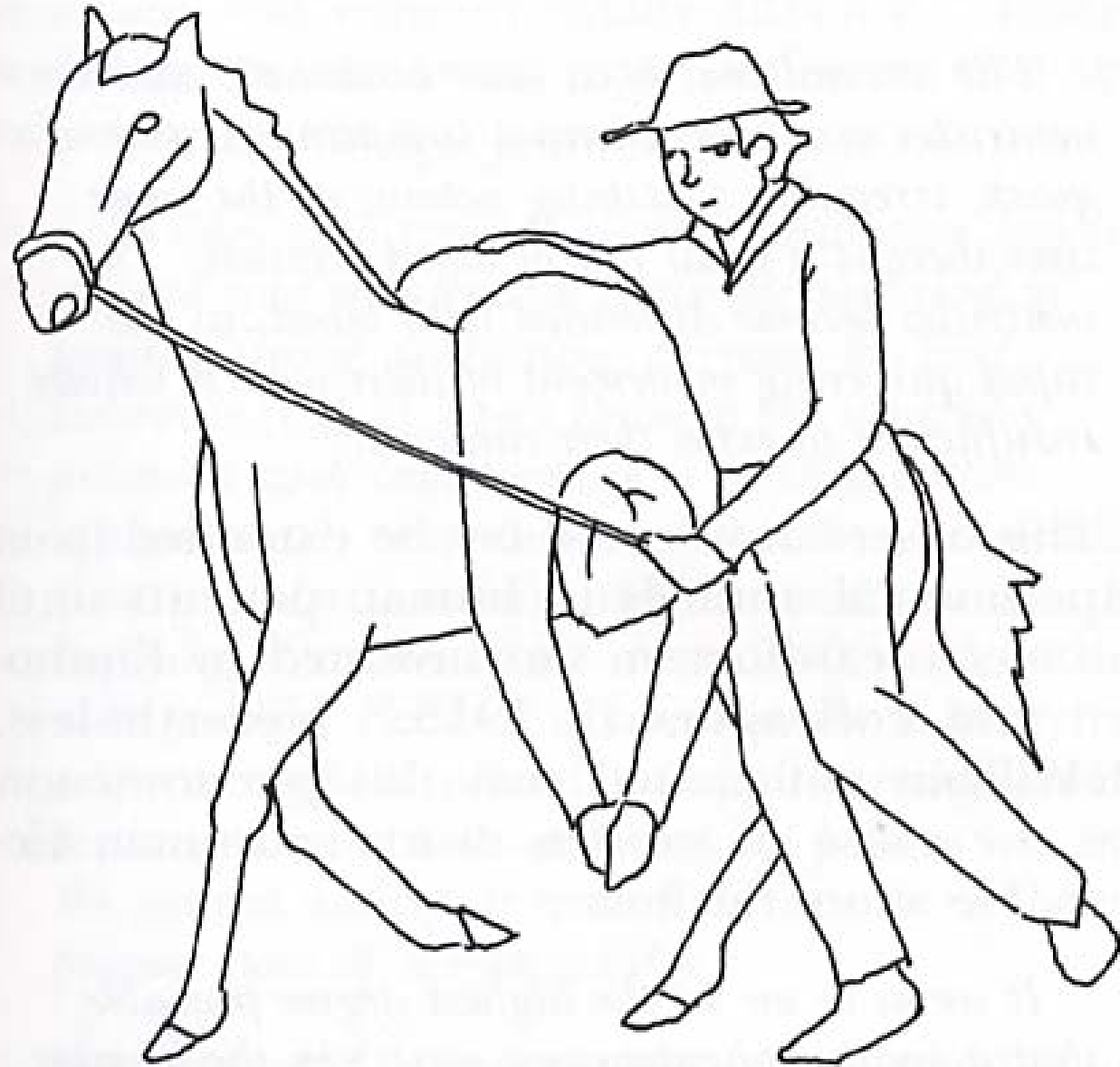
Schafer's method



Barrel method.



Inversion method.



Trotting horse method



"Thank heavens the plumber knows CPR!"

Cardiac Arrest

- What is a “successful resuscitation?”
 - Return of spontaneous circulation (ROSC)?
 - Survival to hospital admission?
 - Survival to hospital discharge?
 - Neurologic recovery? How much?

Cardiac Arrest

Myth: High dose epinephrine (HDE) is associated with a higher rate of "successful resuscitation."

Cardiac Arrest

Reality:

1. HDE *may be* associated with an increase in ROSC and survival to hospital *admission*.

Cardiac Arrest

Reality:

1. HDE *may be* associated with an increase in ROSC and survival to hospital *admission*.
2. HDE is *not* associated with an increase in hospital *discharge* or neurologic recovery.
3. HDE may be associated with a *decrease* in neurologic recovery.

Cardiac Arrest

Myth: Amiodarone is effective in cases of pulseless VT/VF.

Cardiac Arrest

- Amiodarone – Class IIb
- Lidocaine – Class Indeterminate

Is amiodarone the *preferred* drug (higher class rating) for shock-resistant VT/VF in ACLS?

Strength of evidence.

Force of habit.



The **ALIVE*** trial recently confirmed that, when Cordarone I.V. was used instead of lidocaine in cardiac arrest due to shock-refractory VF/pulseless VT, nearly twice as many patients survived to hospital admission—23% vs. 12%.¹

This new evidence, as well as the findings of the **ARREST**² trial and other clinical data that led to the inclusion of Cordarone I.V. on the ACLS guidelines,³ showed that, when doctors turned to **Cordarone I.V.**, patients had a much better chance of getting to the hospital alive.^{2,3}

Cordarone[®] (amiodarone HCl) 150 mg/3 mL

Instead of lidocaine.

Cordarone I.V. is indicated for initiation of treatment and prophylaxis of frequently recurring ventricular fibrillation and hemodynamically unstable ventricular tachycardia in patients refractory to other therapy.

Cordarone I.V. is contraindicated in patients with cardiogenic shock, marked sinus bradycardia, and second- or third-degree AV block in the absence of a functioning pacemaker. Hypotension is the most common adverse effect seen with Cordarone I.V. and may be related to the rate of infusion. In clinical trials, the most important treatment-emergent adverse effects were hypotension (16%), bradycardia (4.9%), liver function test abnormalities (3.4%), cardiac arrest (2.9%), VT (2.4%), congestive heart failure (2.1%), cardiogenic shock (1.3%), and AV block (0.5%).

Please see adjacent page for brief summary of Prescribing Information and list of references.

¹Amiodarone vs. Lidocaine In pre-hospital refractory Ventricular fibrillation Evaluation
²Amiodarone in out-of-hospital Resuscitation of REfractory Sustained ventricular Tachyarrhythmias
³On the VF/pulseless VT algorithm

Cardiac Arrest

- “The clinical effect of amiodarone...was to change the location of death. Our colleagues from Europe [involved in creating the 2000 AHA Guidelines] have been quite candid in asking ‘why would anyone want to use a drug that does nothing more than add the cost of extra days of expensive in-hospital care, but does not add a single person to the number of survivors?’”

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Senior ACLS Science Editor

Cardiac Arrest

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Cardiac Arrest

Reality: 2005 AHA Guidelines

- Antiarrhythmics: “There is no evidence that any antiarrhythmic drug given routinely during human cardiac arrest increases survival to hospital discharge.” (Hazinski, *Circulation*, 2005)

Cardiac Arrest

Myth: Vasopressin is superior to EPI for patients with cardiac arrest.

- C Circulation: establish IV access
- C Circulation: identify rhythm → monitor
- C Circulation: administer drugs appropriate for rhythm and condition
- D Differential Diagnosis: search for and treat identified reversible causes

- *Epinephrine* 1 mg IV push, repeat every 3 to 5 minutes
- or
- *Vasopressin* 40 U IV, single dose, 1 time only

Resume attempts to defibrillate
1 × 360 J (or equivalent *biphasic*) within 30 to 60 seconds

Cardiac Arrest

- Vasopressin
 - Naturally occurring ADH
 - V₁ receptors in vascular SM
 - V₂ receptors in renal collecting duct
 - High doses → potent peripheral vasoconstriction (>> central effect)

Cardiac Arrest

- Vasopressin
 - Effect is similar to EPI's alpha effect...
 - increased diastolic aortic BP and coronary perfusion pressure

Cardiac Arrest

- Vasopressin
 - Effect is similar to EPI's alpha effect...
 - increased diastolic aortic BP and coronary perfusion pressure
 - but without the beta effect
 - increased myocardial oxygen consumption
 - increased incidence of post-resuscitation MI

Cardiac Arrest

- Vasopressin → pig studies
 - Improved coronary perfusion pressure
 - Improved vital organ blood flow
 - Improved cerebral oxygen delivery
 - No increase in myocardial oxygen demand
 - Improved ROSC

Cardiac Arrest

Reality: 2005 AHA Guidelines

- Vasopressors: “To date no placebo-controlled trials have shown that administration of any vasopressor agent at any stage during management of pulseless VT, VF, PEA, or asystole increases the rate of neurologically intact survival to hospital discharge.” (Hazinski, *Circulation*, 2005)

Cardiac Arrest

- Gueugniaud, et al (*N Engl J Med*, 2008)
 - Randomized prehospital trial VP vs. EPI
 - 2894 patients
 - VP + EPI vs. EPI alone
 - Additional dosages of same
 - 80% of patients presented in asystole
 - Results...

Cardiac Arrest

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 - No difference in ROSC, survival to admission or discharge, neurologic recovery, but...

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 - Trend to worse neurologic outcome in survivors that received VP

Cardiac Arrest

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 - Randomized prehospital trial VP vs. EPI
 - No difference in ROSC, survival to admission or discharge, neurologic recovery, but...
 - Trend to worse neurologic outcome in survivors that received VP
 - Good neuro outcome with EPI group: 51.5%
 - Good neuro outcome with VP group: 37.5%

Cardiac Arrest: Summary of Changes

Major Changes in the 2005 AHA Guidelines
for CPR and ECC: Reaching the Tipping
Point for Change

(Hazinski MF, Circulation 2005)

- Summary (all to improve compressions)
 - A
 - 3
 - A
 - 2
 - 2 minutes of compressions after *each* shock before pulse check
 - D

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 - Avoid stacked shocks and escalating dosages of Joules
 - 2 minutes of compressions before first shock
 - 2 minutes of compressions after *each* shock before pulse check
 - De-emphasis on ALL medications

The New AHA Motto...

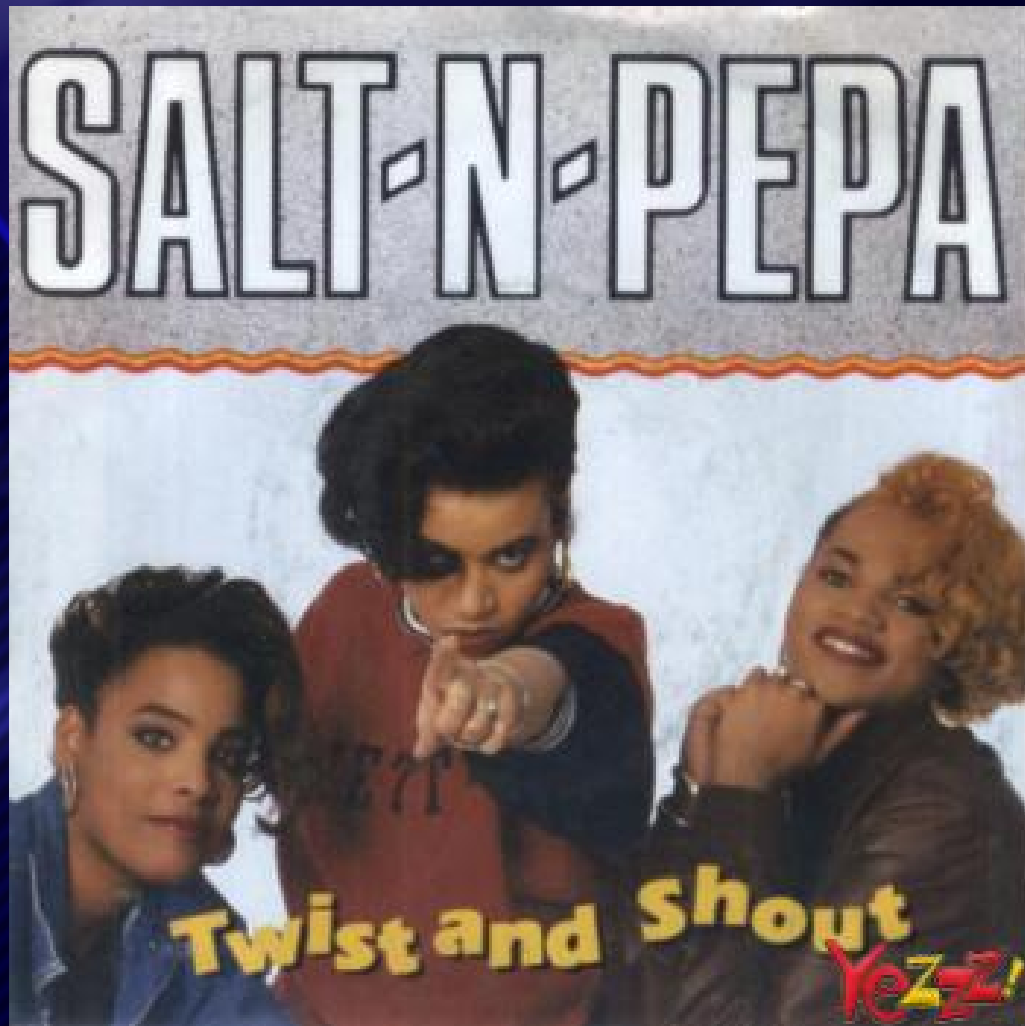
The New AHA Motto...

**“Push hard...
push fast!”**

The New AHA Motto...

**“Push it good...
push it real
good!”**

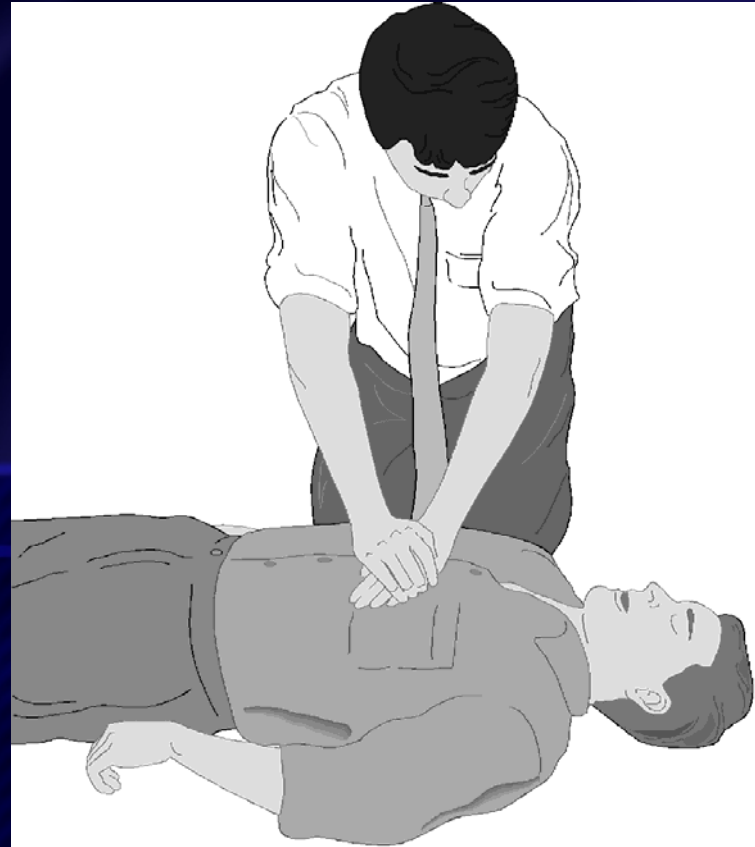
The New AHA Motto...



"Push it good...
push it real
good!"

So what works??

So what works??



2010

Case 1

- 45 yo man presents to the ED with atypical chest pain, wife present
- In room for 20 minutes, then...
- Diaphoretic



Case 1

- 45 yo man presents to the ED with atypical chest pain, wife present
- In room for 20 minutes, then...
- Diaphoretic
- Clutches chest



Case 1

- 45 yo man presents to the ED with atypical chest pain, wife present
- In room for 20 minutes, then...
- Diaphoretic
- Clutches chest
- Unresponsive

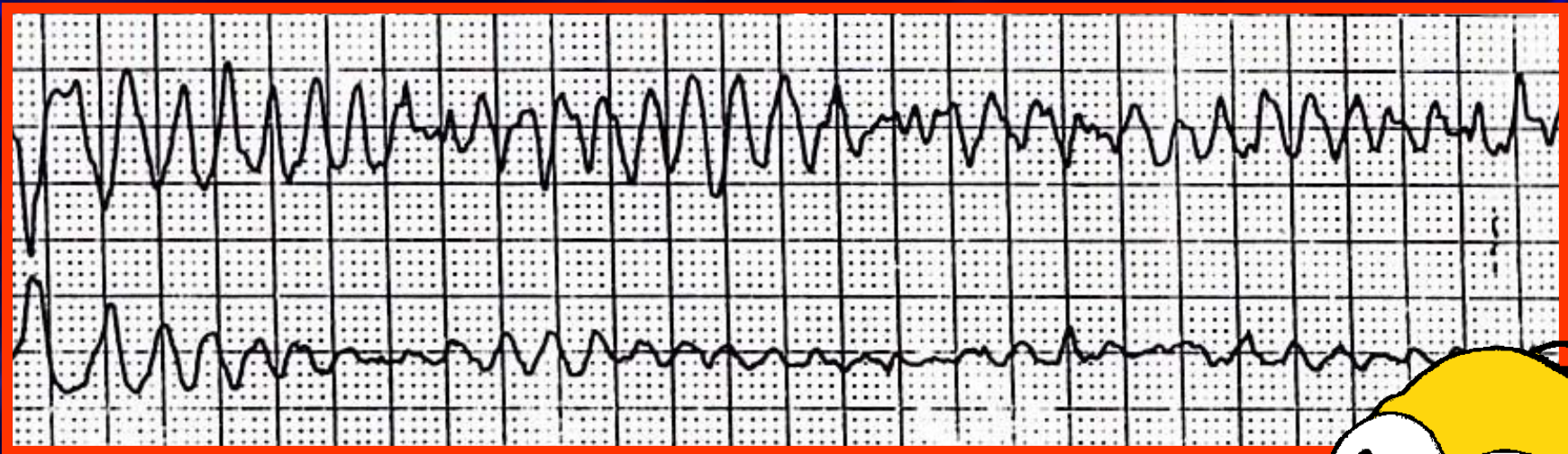


Case 1

- 45 yo man presents to the ED with atypical chest pain, wife present
- In room for 20 minutes, then...
- Diaphoretic
- Clutches chest
- Unresponsive
- Monitor...



Case 1



Case 1

- Patient gets “standard 2009” care:

Case 1

- Patient gets “standard 2009” care:
 - BVM (12/min), good compressions
 - Rapid defibrillation ASAP
 - Maximum joules
 - One time
 - Resume BVM and compressions
 - Rapid intubation, ventilation 12/min
 - \pm Drugs \rightarrow vasopressor, antiarrhythmic
 - Defibrillation again in 2 minutes
 - Etc.

Cardiac Arrest

- What could have been done differently?

Cardiac Arrest

- What could have been done differently?
 - BVM (12/min), good compressions
 - Rapid defibrillation ASAP
 - Maximum joules
 - One time
 - Resume BVM and compressions
 - Rapid intubation, ventilation 12/min
 - ± Drugs → vasopressor, antiarrhythmic
 - Defibrillation again in 2 minutes
 - Etc.

A-B-C?

Cardiac Arrest

- What recent literature is demonstrating?
 - Positive pressure ventilation (MTM, bagging, ETI) have adverse consequences

Cardiac Arrest

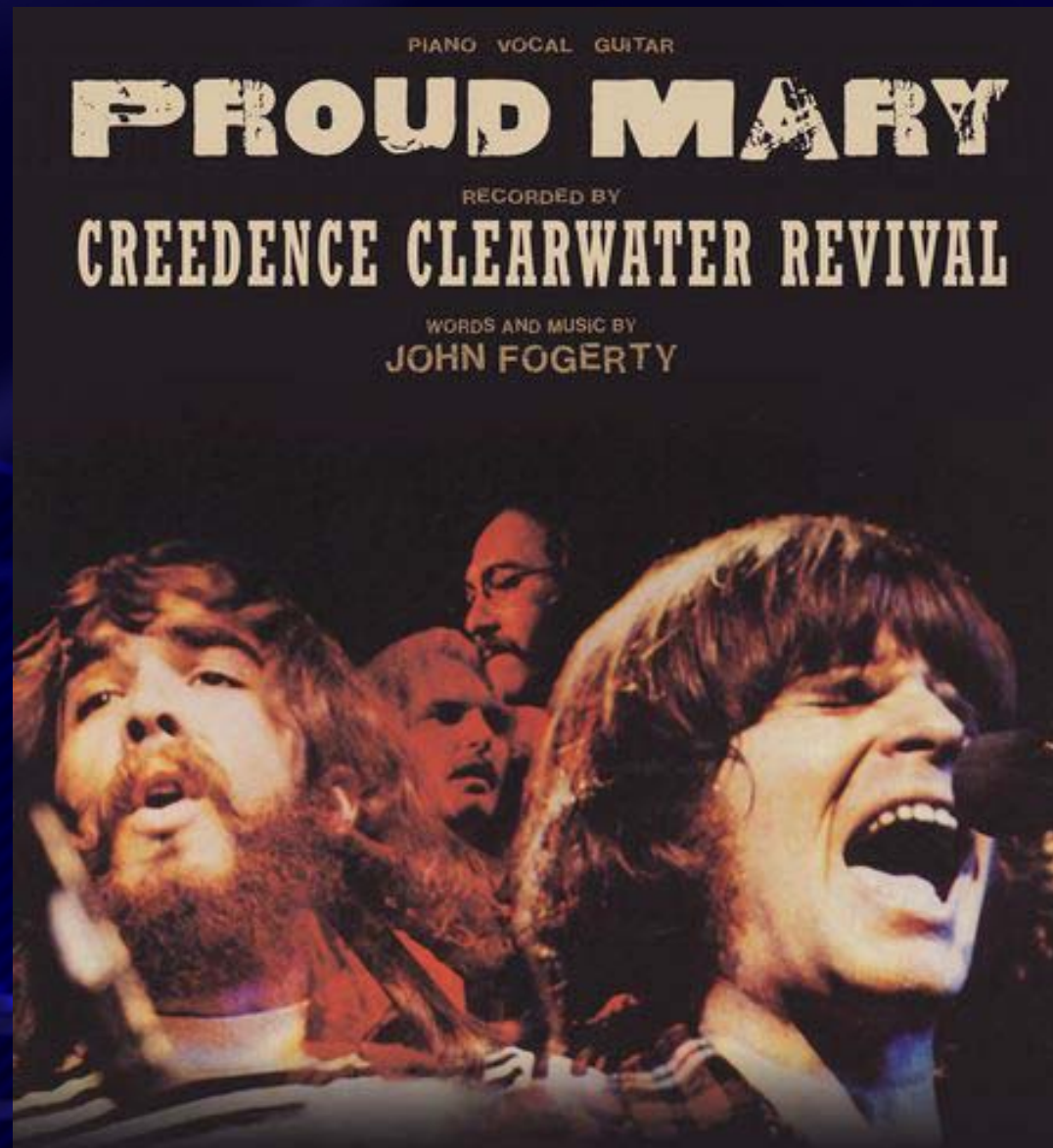
- What recent literature is demonstrating?
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 - Causes reduction in compression rates
 - Decreased CO and cerebral perfusion

Cardiac Arrest

- What recent literature is demonstrating?
 - Positive pressure ventilation (MTM, bagging, ETI) have adverse consequences
 - Causes reduction in compression rates
 - Decreased CO and cerebral perfusion
 - Probably not necessary early after sudden cardiac arrest (central oxygen sats. okay)

ABC → CCR?

ABC → CCR?



Cardiac Arrest

1. Recent Advances in Cardiopulmonary Resuscitation: Cardiocerebral Resuscitation
(Ewy, et al. J Am Coll Cardiol 2009)
2. Improved Patient Survival Using a Modified Resuscitation Protocol for Out-of-Hospital Cardiac Arrest
(Garza, et al. Circulation 2009)

Cardiac Arrest

- 1-2. Cardiocerebral Resuscitation
- Concept first described in 2002

Cardiac Arrest

1-2. Cardiocerebral Resuscitation

- Concept first described in 2002
 - Continuous chest compressions without ventilation
 - Delayed PPV and intubation
 - Early EPI (to promote circulation)

Cardiac Arrest

1-2. Cardiocerebral Resuscitation

(Kellum, et al. Ann Emerg Med 2008)

- Studied CCR for prehospital witnessed arrests with an initially shockable rhythm
- CCR initiated by EMS personnel
- Non-rebreather mask only, until ROSC or 5 cycles of compressions (10 min!) + shocks
- Early EPI

Cardiac Arrest

1-2. Cardiocerebral Resuscitation

(Kellum, et al. Ann Emerg Med 2008)

- Overall survival increased from 20% → 47%
- Survival neurologically intact increased from 15% → 39%

Cardiac Arrest

2. Cardiocerebral Resuscitation
(Garza, et al. Circulation 2009)

Cardiac Arrest

2. Cardiocerebral Resuscitation

(Garza, et al. Circulation 2009)

- Compared 1097 pts. receiving "old" protocol vs. 339 pts. receiving CCR
- Pre-hospital VF arrest in adults
- Presumed cardiac cause (e.g. not drowning, OD, etc.)
- "Gentle" ventilations (50:2), NRB mask
- No intubation for 3 cycles (6 minutes)

Cardiac Arrest

2. Cardiocerebral Resuscitation

(Garza, et al. Circulation 2009)

- For patients with witnessed arrest
 - Survival to discharge 22% → 44%
 - 88% of these CCR survivors discharged with good neurological outcome

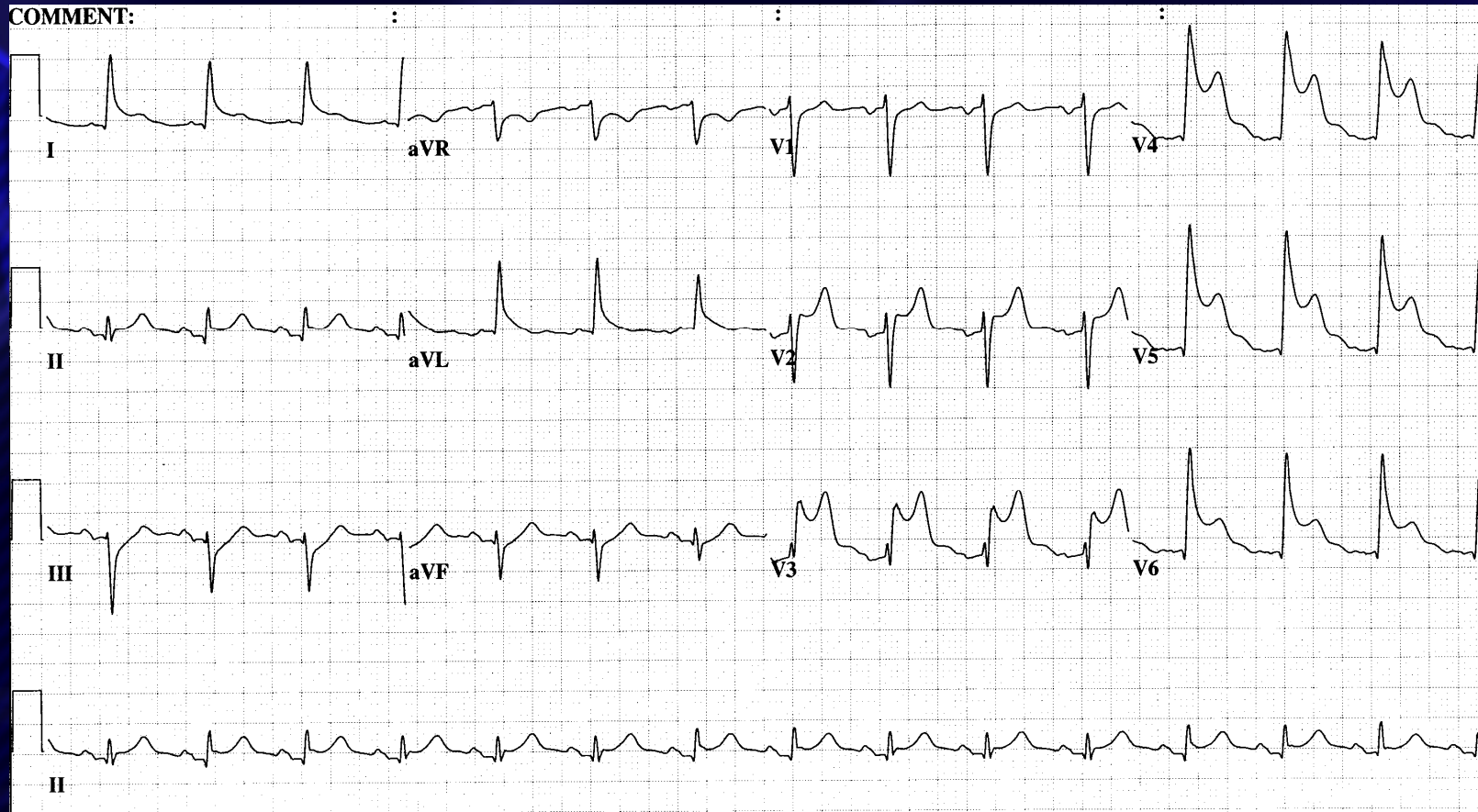
Case 1

Case 1

- Patient gets ROSC but still unconscious
- (Pre- or) Post-arrest ECG...

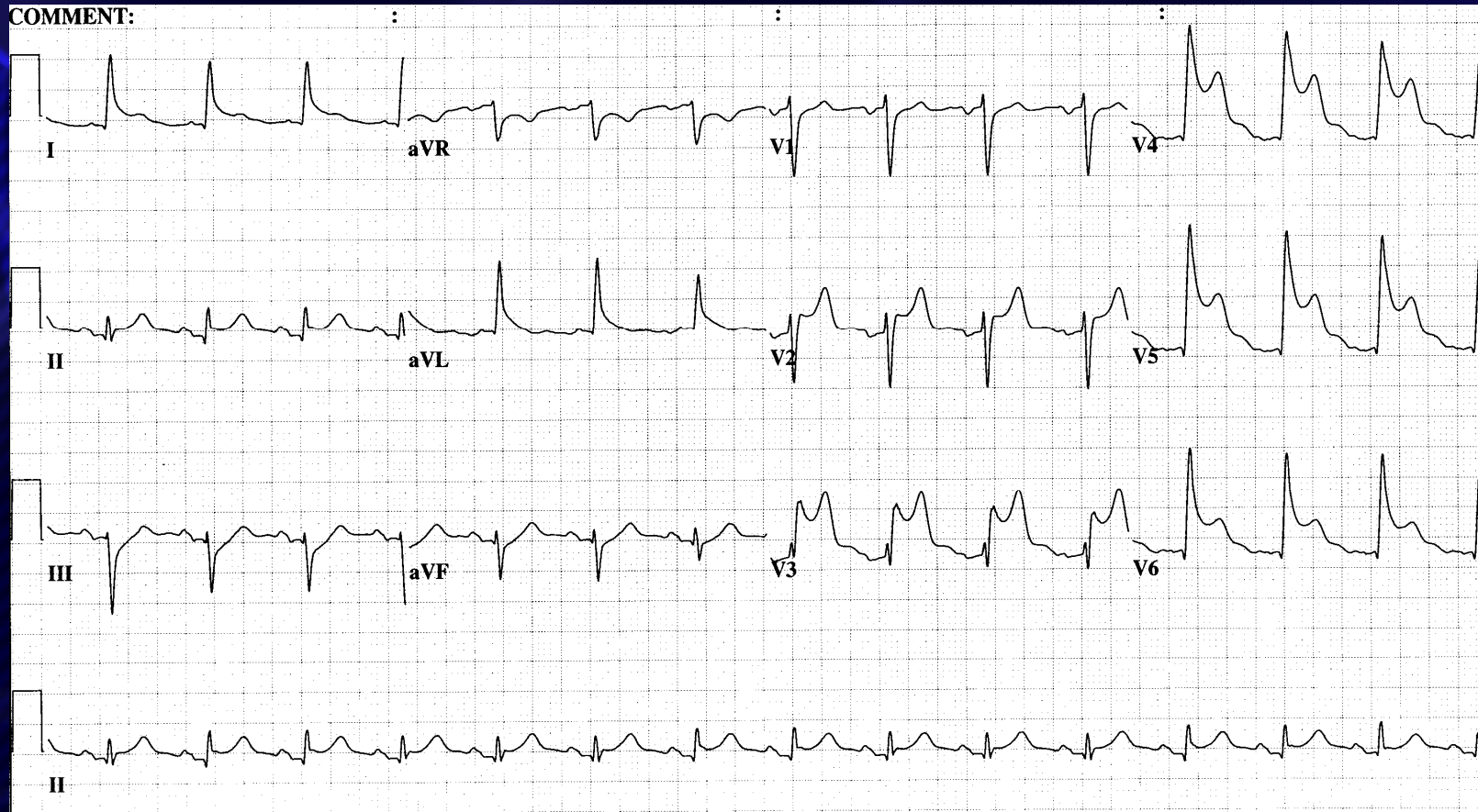
Case 1

- (Pre- or) Post-arrest ECG...



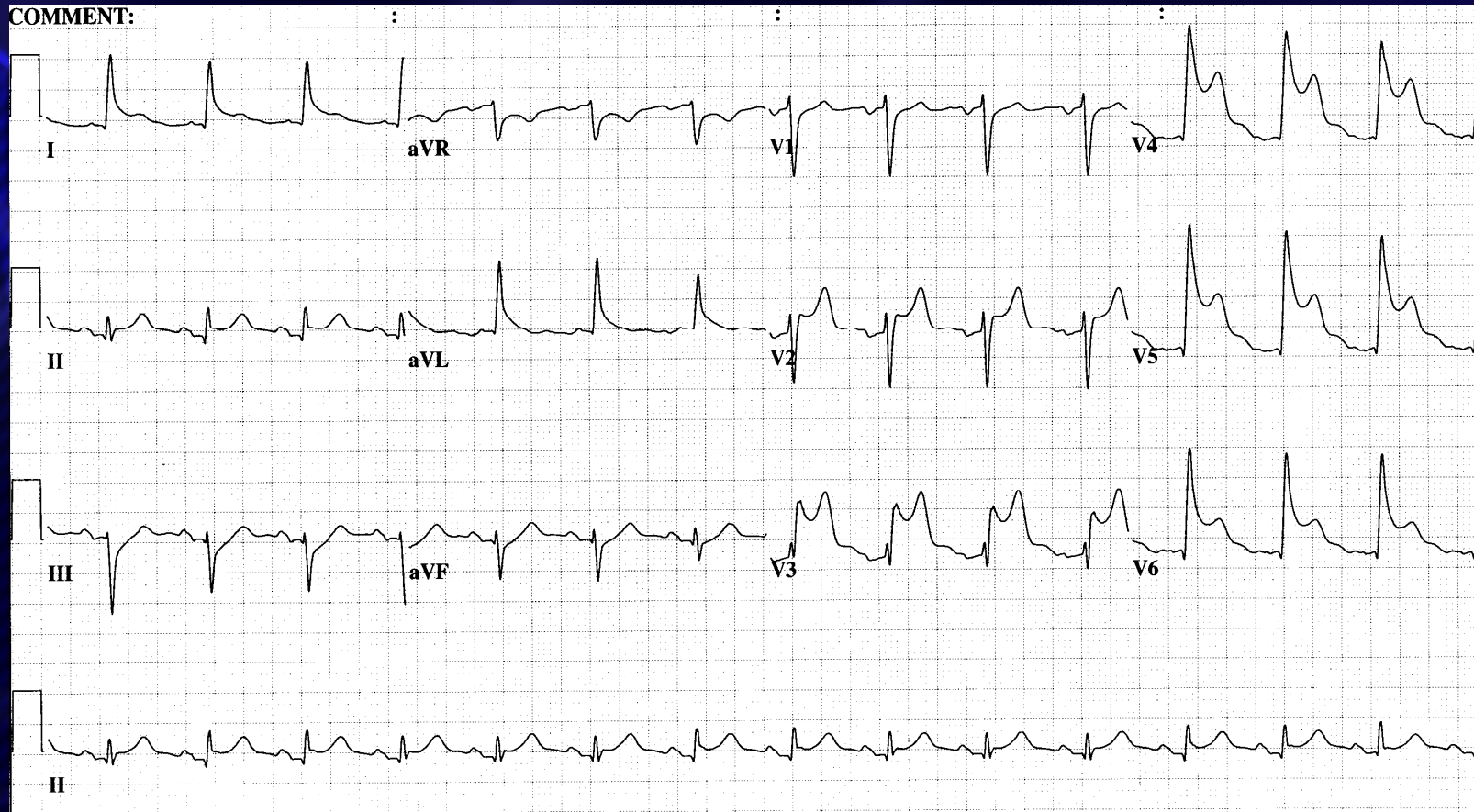
Case 1

- Do you activate the cath lab??



Case 1

- Do you activate the cath lab?? At 1am?



Case 1

- Do you activate the cath lab?? At 1am?



Cardiac Arrest

3. Survival and Neurologic Recovery in Patients With STEMI Resuscitated From Cardiac Arrest
(Hosmane, et al. J Am Coll Cardiol 2009)
4. Emergency PCI in Patients With STEMI Complicated by OOHCA
(Lettieri, et al. Am Heart J 2009)

Cardiac Arrest

3. Survival and Neurologic Recovery in Patients With STEMI Resuscitated From Cardiac Arrest

(Hosmane, et al. J Am Coll Cardiol 2009)

- 98 pts underwent PCI after resuscitation
 - 64% survived
 - 92% of these had full neurological recovery

Cardiac Arrest

3. Survival and Neurologic Recovery in Patients With STEMI Resuscitated From Cardiac Arrest

(Hosmane, et al. J Am Coll Cardiol 2009)

- What about unconscious post-resus?

Cardiac Arrest

3. Survival and Neurologic Recovery in Patients With STEMI Resuscitated From Cardiac Arrest

(Hosmane, et al. J Am Coll Cardiol 2009)

- What about unconscious post-resus?
 - 59 pts
 - 44% survival
 - 88% of these had full neurologic recovery

Cardiac Arrest

4. Emergency PCI in Patients With STEMI Complicated by OOHCA
(Lettieri, et al. Am Heart J 2009)
 - OOHCA patients with STEMI going for PCI (and surviving) had similar 6-month outcome to non-CA patients
 - 87% favorable neuro status at 1 year

Cardiac Arrest

Regional Systems of Care for OOHCA: A
Policy Statement from the AHA
(Circulation Feb 9, 2010)

Cardiac Arrest

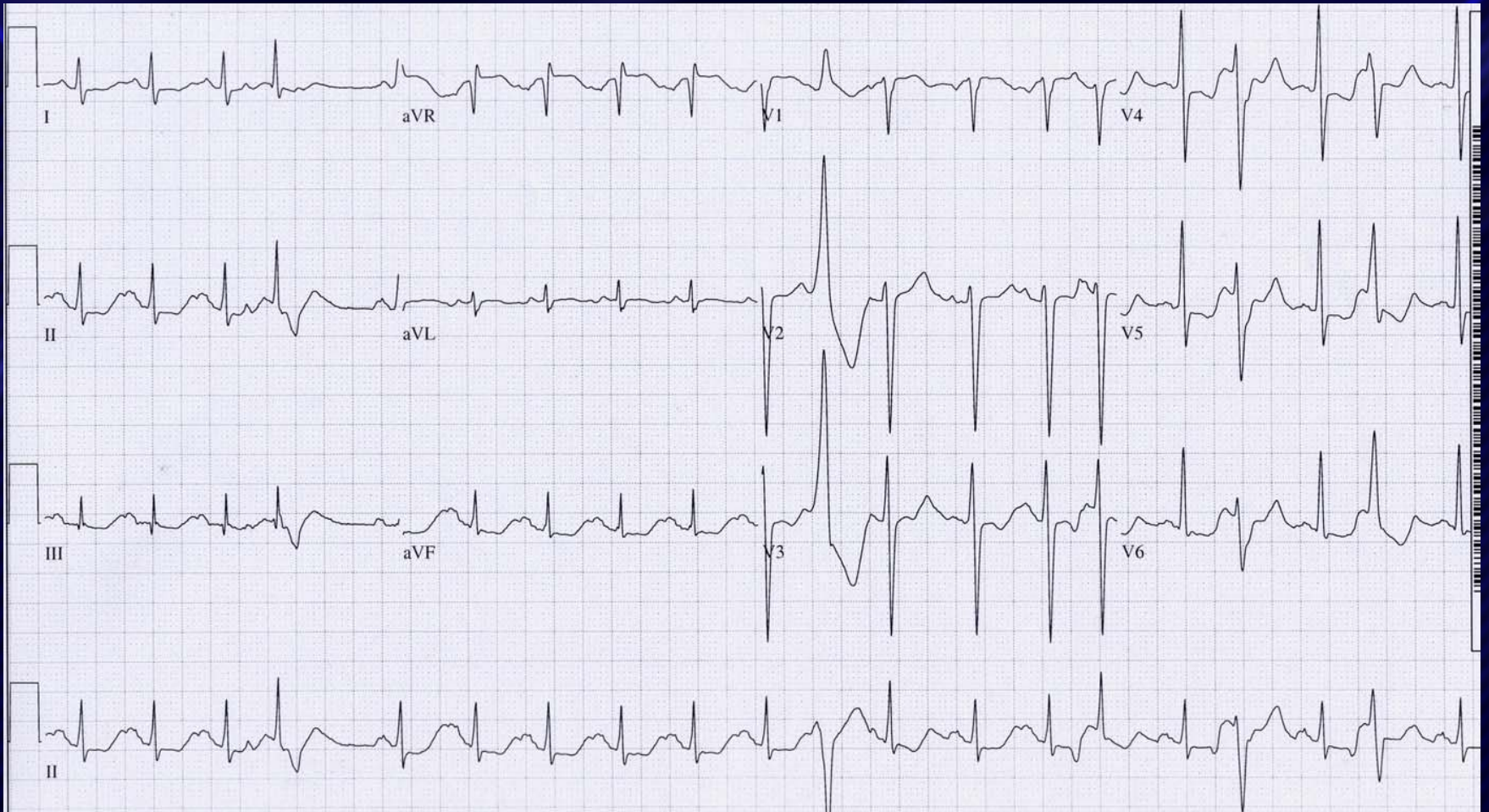
Regional Systems of Care for OOHCA: A Policy Statement from the AHA
(Circulation Feb 9, 2010)

- If OOHCA associated with STEMI, field providers should **bypass nearest hospitals** and go directly to a cardiac resus receiving hospital so patients can **receive angiography within 90 minutes**

Case 1...what if...

Case 1...what if...

- ECGs show non-STEMI...activate cath?



Case 1...what if...

- ECGs show non-STEMI...activate cath?



Cardiac Arrest

5. Coronary Angiography Predicts Improved Outcome Following CA
(Reynolds, et al. J Int Care Med 2009)

Cardiac Arrest

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 - 241 pts, 40% received cath.

Cardiac Arrest

5. Coronary Angiography Predicts Improved Outcome Following CA (Reynolds, et al. J Int Care Med 2009)
- 241 pts, 40% received cath.
 - Improved survival and outcome associated with cath, *regardless* of...
 - Presenting rhythm
 - Presence of STEMI or new LBBB
 - Neurologic status

Cardiac Arrest

5. Coronary Angiography Predicts Improved Outcome Following CA (Reynolds, et al. J Int Care Med 2009)
- Improved survival and outcome associated with cath, *regardless* of...
 - Presenting rhythm
 - Presence of STEMI or new LBBB
 - Neurologic status
 - Cath independently associated with good outcome

Cardiac Arrest

Regional Systems of Care for OOHCA: A Policy Statement from the AHA (Circulation Feb 9, 2010)

- "Absence of STE on 12-lead ECG...is not strongly predictive of the absence of coronary occlusion on acute angiography."
- Increasing support for rapid PCI regardless of ECG after ROSC

Cardiac Arrest

1. Recent Advances in CPR: CCR
(Ewy, et al. **J Am Coll Cardiol** 2009)
 - Urgent cardiac catheterization
 - The most influential factor in survival
 - Regardless of whether or not STEMI!

Cardiac Arrest

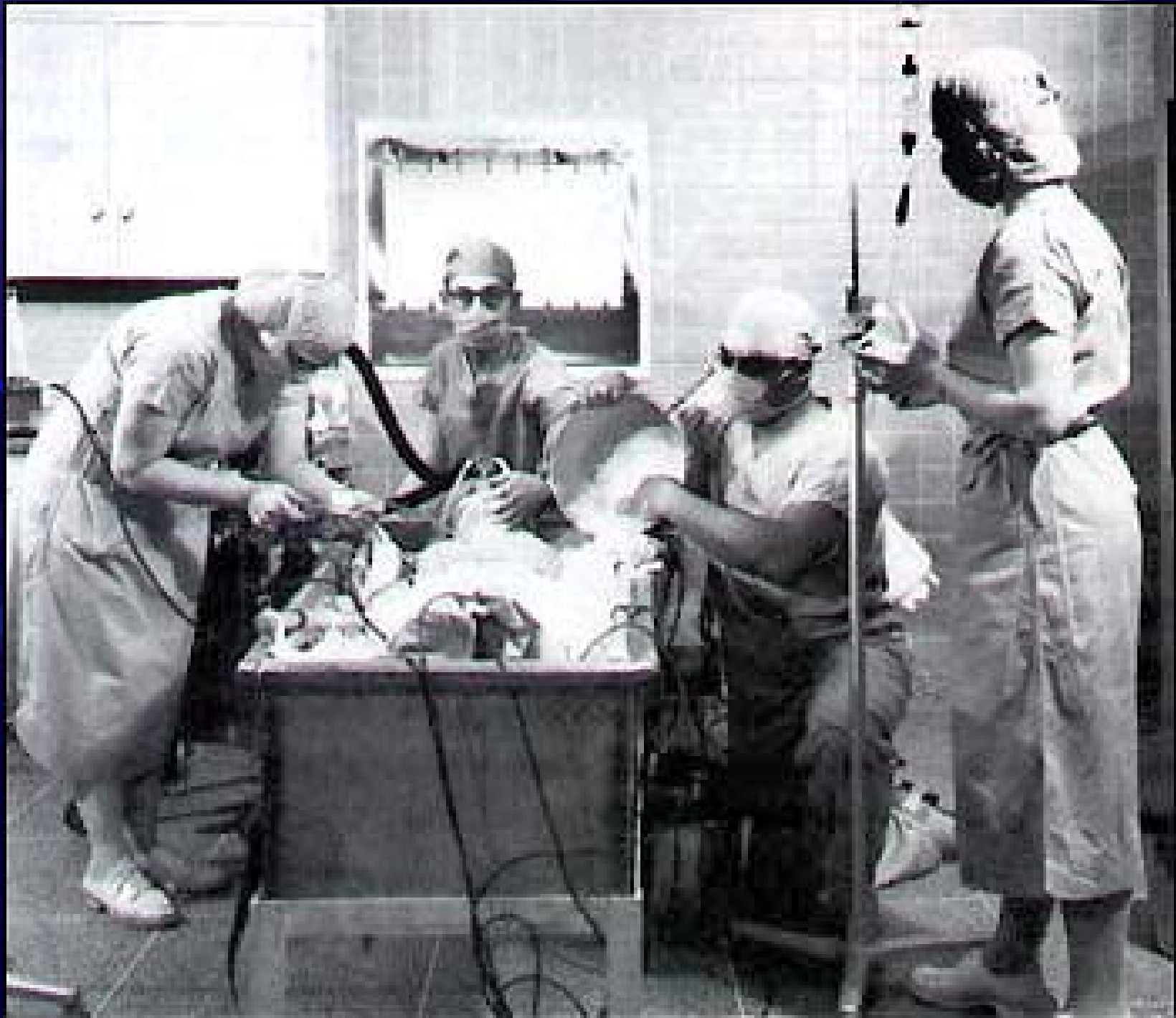
Historical advances in Tx of cardiac arrest

- 1980s-1990s → rapid defibrillation
- Early 2000s → therapeutic hypothermia
- Late 2000s → CCR, rapid PCI

Case 1...

Case 1...

- Plan → emergent PCI
- Patient still unconscious
- Before the cath, should we....?



Case 1...

6. Mild therapeutic hypothermia in patients after OOHCA due to STEMI undergoing immediate PCI

(Wolfrum, et al. Crit Care Med 2008)

- Small study showed trend to...
 - Lower 6-month mortality
 - Improved neurologic status
 - No change in door-to-balloon times

Cardiac Arrest

- Summary
 - CCR > ABC and CPR
 - Airway in most CAs → no rush!
 - Immediate PCI for STEMI regardless of neuro status
 - Increasing support for cath for NSTEMI
 - Increasing support for therapeutic hypothermia during PCI

Cardiac Arrest

- Summary
 - CCR > ABC and CPR
 - Airway in most CAs → no rush!
 - Immediate PCI for STEMI regardless of neuro status
 - Increasing support for cath for NSTEMI
 - Increasing support for therapeutic hypothermia during PCI
 - Recommendations for regionalization of cardiac arrest care are on the way...!

Thanks!

