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
NEED CASH FOR ALCOHOL RESEARCH
Cardiac Arrest
Bellows method for artificial ventilation.
Marshall Hall’s method
Howard’s method
Schafer’s method
Barrel method.
Inversion 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?
“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?’”

--Richard Cummins, MD, MPH, MSc
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 \( \rightarrow \) 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 \( \times \) 360 J (or equivalent biphasic) within 30 to 60 seconds
Cardiac Arrest

• Vasopressin
  - Naturally occurring ADH
  - $V_1$ receptors in vascular SM
  - $V_2$ receptors in renal collecting duct
  - High doses $\rightarrow$ 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
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

  - 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

  - Randomized prehospital trial VP vs. EPI
  • No difference in ROSC, survival to admission or discharge, neurologic recovery, but…
Cardiac Arrest

  - 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
Cardiac Arrest

  - 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 hyperventilation (max. 12/min)
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• Summary (all to improve compressions)
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  - 100 compressions/min
  - A
  - 2
  - 2 minutes of compressions after each shock before pulse check
  - D
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• Summary (all to improve compressions)
  – Avoid hyperventilation (max. 12/min)
  – 100 compressions/min
  – Avoid stacked shocks and escalating dosages of Joules
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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??
Case 1

- 45 yo many presents to the ED with atypical chest pain, wife present
- In room for 20 minutes, then...
- Diaphoretic
Case 1

- 45 yo many presents to the ED with atypical chest pain, wife present
- In room for 20 minutes, then...
- Diaphoretic
- Clutches chest
Case 1

- 45 yo many presents to the ED with atypical chest pain, wife present
- In room for 20 minutes, then...
- Diaphoretic
- Clutches chest
- Unresponsive
Case 1

- 45 yo many 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
  - ± Drugs → 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?
  – Positive pressure ventilation (MTM, bagging, ETI) have adverse consequences
    • 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 \rightarrow 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)
1-2. Cardiocerebral Resuscitation

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

- Concept first described in 2002
- Continuous chest compressions without ventilation
- Delayed PPV and intubation
- Early EPI (to promote circulation)
1-2. Cardiocerebral Resuscitation

- 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
1-2. Cardiocerebral Resuscitation


- 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


• 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

4. Emergency PCI in Patients With STEMI Complicated by OOHCA
3. Survival and Neurologic Recovery in Patients With STEMI Resuscitated From Cardiac Arrest

- 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
• What about unconscious post-resus?
Cardiac Arrest

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


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


- 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
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Regional Systems of Care for OOHCA: A Policy Statement from the AHA (Circulation Feb 9, 2010)
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- 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
• 241 pts, 40% received cath.
• 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


- 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

   - 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...

- Plan $\rightarrow$ emergent PCI
- Patient still unconscious
- Before the cath, should we...?
6. Mild therapeutic hypothermia in patients after OOHCA due to STEMI undergoing immediate PCI
• 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’s 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’s 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!