IN CARDIAC ARREST MANAGEMENT

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May 2014
Outline

1. Capnography
2. Compressions
3. CPR Devices
4. Hypothermia
5. Access
6. Medications
Capnography & Termination

Significantly Associated with ROSC:
- Witnessed Arrest (OR = 1.51)
- Initial EtCO₂ >10 (OR = 4.79)

Alternatively:
- Male, no bystander CPR, unwitnessed collapse, non-VF arrest, initial EtCO₂ <10
  - 97% predictive of no ROSC

Eckstein, 2011

Capnography

A guide to:

1. Likelihood of ROSC
   - **GOOD**: Abrupt & sustained increased to 35-40
   - **BAD**: <10 is a poor predict
2. Airway Confirmation
3. CPR quality (Goal >20)
Termination Rules

1. There was a return of spontaneous circulation (prior to transport)
2. Arrest witnessed by emergency medical services personnel
3. A shock was delivered

If ALL criteria are present: Transport to local ED
If NONE of the criteria are present: Terminate Resuscitation

But, HOW LONG?

Morrison, Resuscitation 2009

20 minutes?

150 patients in Washington in the 90’s
- EtCO2 @ 20 minutes
  - Survivors: 32.8
  - Non-survivors: 4.4

Levine, NEJM 1997
2: COMPRESSIONS

What they already knew:
Compressions affected ventilation
If alone, only do compressions
“Only the human hand is required”
CPR Quality
- Push hard (≥2 inches [5 cm]) and fast (≥100/min) and allow complete chest recoil
- Minimize interruptions in compressions
- Avoid excessive ventilation
- Rotate compressor every 2 minutes
- If no advanced airway, 30:2 compression-ventilation ratio
- Quantitative waveform capnography
  - If PETCO₂ <10 mm Hg, attempt to improve CPR quality
- Intra-arterial pressure
  - If relaxation phase (diastolic) pressure <20 mm Hg, attempt to improve CPR quality

Compressions

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<tr>
<th>Time (Seconds)</th>
<th>Systolic Blood Pressure</th>
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<tbody>
<tr>
<td>0</td>
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<tr>
<td>15</td>
<td>20</td>
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<tr>
<td>30</td>
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<tr>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>75</td>
<td>70</td>
</tr>
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</table>
**CCR**

*Continuous Chest Compression (CCC) CPR*
- Preferred by bystanders
- Equivalent or better resuscitation rates

*Cardiocerebral CPR*
- 200 uninterrupted chest compressions @100/min
- Rhythm analysis with a single shock if indicated
- Immediately followed by 200 postshock chest compressions before any pulse check or rhythm reanalysis.
- ETI delayed until after 3 cycles
- IV epi administered as soon as possible during the protocol and again with each cycle

*More Info:* SHARE Program @ Univ. of Arizona Sarver Heart Center

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**CCR vs CPR**

Arm #1: Continuous (6 minutes)
Arm #2: 30:2 (standard) CPR

- Multicenter RCT
- Started June 2011
- Expected completion Oct 2014

3: CPR DEVICES

**Mechanical Piston Device (LUCAS)**

**Load Distributing Band CPR (AutoPulse)**
Load Distributing Band CPR
(AutoPulse)
2004-5 ASPIRE Trial, US multicenter RCT – Halted Early (Dangerous)
  • 4 hour survival same
  • Hospital discharge 5.8% vs 9.9%

“Results are unexpected and there is no obvious explanation”
  – Hawthorne Effect for CPR & Learning curve for device
  – Delay to use?
  – Enrollment bias?

Hallstrom, JAMA 2006

LUCAS in Cardiac Arrest
(LINC Trial)
  • Multicenter RCT (2,589 patients)
  • Mechanical vs Conventional CPR
  • No difference in:
    – 4 hour survival
    – 6 month survival
    – 6 month neurologic outcome

Rubertsson, JAMA 2014
“no alternative technique or device in routine use has consistently been shown to be superior to conventional CPR for out-of-hospital basic life support”
(2010 AHA Guidelines)

“Widespread use of mechanical devices for chest compressions during cardiac events is not supported by this review.”
(2014 Cochrane Review)

4: HYPOTHERMIA
Hypothermia in 2002

Study #1
- 77 patients randomized to 33°C x12 hours
- Favorable neuro outcome:
  - 49% chilled
  - 26% not

Study #2
- VF post arrest, 136 patients randomized to 32-34°C x24 hours
- Favorable neuro outcome:
  - 55% chilled
  - 39% not

6 month mortality down 14%
No difference in complication rate


Hypothermia Today

- 33 vs 36 targeted temperature
- 939 patients
- No difference in survival
- Overall survival better vs 2002

Nielsen, NEJM 2013
5: ACCESS

IO as first line in arrest?

[182 arrest patients]

*1st attempt success:*

- Tibial IO: 91%
- Humeral IO: 51%
- PIV: 43%

*Time to initial success:*

- Tibial IO: 4.6 min
- Humeral IO: 7.0 min
- PIV: 5.8 min

Reades, Ann Emerg Med 2011
In Hospital?

[40 arrest patients]

1st attempt success:

IO: 85%
Central Line: 60%

Time to initial success:

IO: 2 min
Central Line: 8 min

Leidel, Resuscitation  2012

6: MEDICATIONS
Standards for Cardiopulmonary Resuscitation and Emergency Cardiac Care

WITH this issue, THE JOURNAL publishes a supplement that represents a landmark document. It is entitled Standards for Cardiopulmonary Resuscitation and Emergency Cardiac Care. It seems only yesterday in the long history of medicine that resuscitative efforts included such measures as rolling a victim over a barrel and rectal insufflation of smoke. Changes posed by World War II and research that continued into the 1950s culminated in 1966 with the First National Conference on Cardiopulmonary Resuscitation (CPR) that was sponsored jointly by the National Academy of Sciences-National Research Council and the American Heart Association.

One of the most useful drugs in advanced CPR is epinephrine. Its positive inotropic effect improves myocardial contractility. Its positive chronotropic effect can convert asystole to sinus mechanism or speed up bradycardia; its vasopressor effect elevates peripheral vascular resistance so that effective tissue perfusion will be produced by ECC. For defibrillation to be successful, epinephrine is required to coarsen a fine fibrillatory wave (low voltage). This drug is therefore indicated in the three most common forms of cardiac arrest: ventricular fibrillation, asystole and electromechanical dissociation. The dose in an adult is 0.5 mg given initially and repeated at five-minute intervals, or as an infusion of 1 to 4 μg per minute.
Norway 2003-2008

IV drugs vs no IV drugs
6 years, 851 patients
ROSC: 32% vs 21%: BETTER
Survival to discharge: NO CHANGE
Favorable Neuro Outcome: NO CHANGE
1 year survival: NO CHANGE

Overall, no improvement


Western Australia 2006-2009

Epi vs Placebo
4 years, 534 patients
ROSC 23.5% vs 8.4%: BETTER
Survival to discharge 4.0% vs 1.9%: NO CHANGE (OR 0.7-6.3)

No statistically significant improvement

Japan 2005-2008

Epi vs Nothing
4 years, 417,188 patients
ROSC: 18% vs 5%: BETTER
1 month survival: NO CHANGE
Good functional status: 1.4% vs 2.2%: WORSE
(OR 0.21 – 0.71)

Decreased chance of survival and good functional outcome at 1 month
Why?
• Increased lactate, over-constriction of microcirculation, metabolic debt overall
• Promotes dysrhythmias, activates platelets

Hagihara, JAMA. 2012

Summary Statements

“...there is no placebo-controlled study that shows that the routine use of any vasopressor during human cardiac arrest increases survival to hospital discharge.”

“There is no convincing evidence that the routine use of other drugs (atropine, amiodarone, lidocaine, procainamide, bretylium, magnesium, buffers, calcium, hormones, or fibrinolytics) during human CPR increases survival to hospital discharge.”

“There was no clear advantage of epinephrine…the efficacy of vasopressor use in OHCA remains unanswered.”

Morrison, Circulation 2010; Lin, Resuscitation 2014
ALPS
Amiodarone, Lidocaine, or Placebo Study

Refractory VT/VF after 1 shock:

Arm #1: Amiodarone
Arm #2: Lidocaine
Arm #3: Placebo

Est Completed Enrollment: Sept 2015

Steroids?

- Vasopressin VS. Saline
- Epi VS. Epi
- Methylprednisolone 40mg VS. Saline

Mentzelopoulos, JAMA 2013
Ontario PreHospital Advanced Life Support (OPALS) Study

Survival to Discharge Odds Ratios

1. Bystander CPR: 3.7
2. Rapid Defibrillation: 3.4
3. Paramedics with ACLS: 1.1

Stiell, NEJM 2004

SUMMARY

1. Capnography - helpful
2. Compressions - work
3. CPR Devices - equivocal
4. Hypothermia – questionable
5. Access – IO first
6. Medications - dogma
QUESTION

- The medications
- The need to cool
- Everything
- Remember, it wasn’t too long ago we were rolling a victim over a barrel and doing rectal insufflation of smoke!

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