CPR @ 9/2004 - WHAT'S NEW?

Edo Kaluski MD, FACC
Director of CCU, Asaf Harofeh MC
ekaluski@asaf.health.gov.il

KEYWORDS
- Advanced cardiac life support
- Basic life support
- Ventricular tachycardia
- Ventricular fibrillation
- Pulseless electrical activity
- Asystole
- Buffers
- Automatic external defibrillator
- Cardiopulmonary resuscitation
- Brain death & persistent vegetative state.

Incidence
- 400,000 in USA die suddenly (1/1000/y)
- 375-750k have cardiac arrest and attempted resuscitation during hospitalization
- Most common cause CAD (ischemic or infarcted myocardium or electrolyte problem, mechanism poorly understood).
- CAD, CHF & LVH Resulting in VT/VF
- Age 69, Males 69%, >69% die (both in & out of hospital arrests)
- 0.3-1.5/1000 of population experiences every year out of hospital SCD in various reports.

WHAT? Out of hospital SD- King County WA, USA 90-99 5213 patients

VF 40-60%, ASYSTOLE 20-40% (late EMS)

Incidence
- 400,000 in USA die suddenly (1/1000/y)
- 375-750k have cardiac arrest and attempted resuscitation during hospitalization
- Most common cause CAD (ischemic or infarcted myocardium or electrolyte problem, mechanism poorly understood).
- CAD, CHF & LVH Resulting in VT/VF
- Age 69, Males 69%, >69% die (both in & out of hospital arrests)
- 0.3-1.5/1000 of population experiences every year out of hospital SCD in various reports.

WHAT? Out of hospital SD- King County WA, USA 90-99 5213 patients

VF 40-60%, ASYSTOLE 20-40% (late EMS)
Out of hospital SD - King County WA, USA 90-99
5213 patients

Core Training Objectives (1)
1. Recognize & treat pre-arrest conditions (like ACS, stroke & respiratory failure).

Core Training Objectives (2)
2. Manage 1st 10 minutes of arrest due to VF
   - BLS & AED + defibrillator
   - Airway support, ventilation & oxygenation
   - Vascular access
3. Correctly treat 4 arrest rhythms:
   a. VF
   b. VT
   c. PEA
   d. Asystole

Core Training Objectives (3)
4. Managing death, brain death, anoxic encephalopathy, PVS

No other procedure in cardiology carries failure rate of 70-99%
Hence it is our responsibility:

- To provide the required education (to patients, bystanders, on-duty personal, and medical staff).
- To optimize our local chain of survival.
- To emphasize CV prevention and not SCD prevention.

**EARLY EDUCATION BLS (SCHOOL, PEERS>40y)**

Education in Resuscitation
An ILCOR Symposium
Utrecht Abbey
Stavanger, Norway
Page 52/73, 2929
Correlation: 2031.078.2677-2654
Writing Group
Douglas A. Chamberlain, CBE, MD (Cochrane); Mary Fran Hennessey, RN, MSN (Cochrane)

On behalf of the European Resuscitation Council, the American Heart Association, the Heart and Stroke Foundations of Canada, the Resuscitation Council of Southern Africa, the American and New Zealand Resuscitation Council, and the Consejo Latino-American de Resuscitación.

<table>
<thead>
<tr>
<th>Theoretical Model of Factor to Patient Outcome</th>
<th>Guidelines Quality</th>
<th>Education of Patient care Givers &amp; pts.</th>
<th>Function of Local chain of Survival</th>
<th>Patient Survival Relative to Threshold Potential (Factors Sufficient)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Gp</td>
<td>0.9</td>
<td>0.5</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.9</td>
<td>0.3</td>
<td>0.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.9</td>
<td>0.3</td>
<td>0.9</td>
</tr>
</tbody>
</table>

BLS for Layperson with duty to response & healthcare Providers

**HISTORY OF 1200 VICTIMS OF CARDIAC ARREST**

**Table 1. Cardiovascular History of the Patients.**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Vasopressor Group (N=589)</th>
<th>Epinephrine Group (N=597)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary heart disease (%)</td>
<td>40%</td>
<td>18%</td>
<td>0.23</td>
</tr>
<tr>
<td>Hypertension (%)</td>
<td>18%</td>
<td>17%</td>
<td>0.88</td>
</tr>
<tr>
<td>Diabetes (%)</td>
<td>17%</td>
<td>14%</td>
<td>0.99</td>
</tr>
<tr>
<td>Left ventricular failure (%)</td>
<td>13%</td>
<td>13%</td>
<td>0.99</td>
</tr>
<tr>
<td>Pericardial vascular disease (%)</td>
<td>13%</td>
<td>12%</td>
<td>0.99</td>
</tr>
<tr>
<td>Cardiac arrhythmias (%)</td>
<td>77%</td>
<td>75%</td>
<td>0.53</td>
</tr>
<tr>
<td>Pacemaker (%)</td>
<td>4%</td>
<td>2%</td>
<td>0.43</td>
</tr>
<tr>
<td>Valvular heart disease (%)</td>
<td>3%</td>
<td>3%</td>
<td>0.74</td>
</tr>
<tr>
<td>Cardiomyopathy (%)</td>
<td>2%</td>
<td>4%</td>
<td>0.85</td>
</tr>
</tbody>
</table>

80% SCD patients are at mild risk (warrant moderate measures)
MI & SCD are the 1st Manifestations of CAD in >60% of pts.

**EARLY PREVENTION**

1. Unpredictable: Most people who have SCD are at low risk
2. Mostly primary: Most those who had SCD do not get a 2nd chance

**POST MI**

**Class I**
- Beta blockers
- ACE inhibitors
- Angiotensin II receptor blockers

**Class IIa**
- Lipid-lowering drugs
- Antithrombotics

**Class IIb**
- Antithrombotics
- Beta blockers

**Hemodynamically Tolerated VT**

**EF<40%spont VTs Inducible by PES**

**POST MI LVEF<30 QRS, TWI, FC (MAD 2)**

**ICD?**
- ICD: VVI, VVT with sustained ventricular tachycardia, VT, or fibrillation.
- No ICD: Beta blockers, ACE inhibitors, Angiotensin II receptor blockers.

**European Heart Journal (2013) 34, 11-15**
### Prophylactic Defibrillator Implantation in Patients with Nonischemic Dilated Cardiomyopathy

- **Alan Kadir**, M.D., Alan Dyer, Ph.D., James P. Daubert, M.D., Rebecca Quigg, M.D., N.A. Mark Estes, M.D., Kelley P. Anderson, M.D., Hugh Calkins, M.D., David Hoch, M.D., Jeffrey Goldberger, M.D., Alaa Shalaby, M.D., William E. Sanders, M.D., Ani Schachter, B.S.N., R.N., and Joseph H. Levine, M.D., for the Defibrillators in Non-Ischemic Cardiomyopathy Treatment Evaluation (DEFINITE) Investigators

### Update of the guidelines on sudden cardiac death of the European Society of Cardiology

- Silvio G. Priori, Etienne Alot, Carina Blomstrom-Lundqvist, Leo Bossert, Gunter Breithardt, Pedro Brugada, John A. Camm, Ricardo Cappato, Stuart M. Cobb, Carie DiMarco, Barry J. Maron, William J. McKenna, Anders K. Pedersen, Ursula Ramens, Peter J. Schwartz, Maria Tracqui-Giussi, Patricio Varela, Hein J.J. Wellens, Douglas P. Zipes

### Table: Prophylactic Defibrillator Implantation in Patients with Nonischemic Dilated Cardiomyopathy

<table>
<thead>
<tr>
<th>DRUG</th>
<th>Patients (n)</th>
<th>RR death/SCD</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sotalol</td>
<td>2123</td>
<td>0.63 (0.5-0.7)</td>
<td>0.0006</td>
</tr>
<tr>
<td>Diltiazem</td>
<td>2611</td>
<td>0.63 (0.5-0.7)</td>
<td>0.0005</td>
</tr>
<tr>
<td>Calcium channel blockers</td>
<td>20 480</td>
<td>0.63 (0.5-0.7)</td>
<td>0.0001</td>
</tr>
</tbody>
</table>

### Figure 1: Kaplan-Meier Estimates of Death from Any Cause (Panel A) and Sudden Death from Arrhythmia (Panel B) among Patients Who Received Standard Therapy and Those Who Received an Implantable Cardioverter-Defibrillator (ICD)

- In the ICD group, as compared with the standard therapy group, the hazard ratio for death from any cause was 0.65 (95% confidence interval, 0.40 to 1.06) and the hazard ratio for sudden death from arrhythmia was 0.20 (95% confidence interval, 0.06 to 0.72).
Prevention By ICD

<table>
<thead>
<tr>
<th>Disease</th>
<th>Setting</th>
<th>Recommendations</th>
<th>Level of evidence</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-MI</td>
<td>Resuscitated VT/VE</td>
<td>Class I</td>
<td>A* [187,207-212]</td>
<td></td>
</tr>
<tr>
<td>Post-MI</td>
<td>Primary prevention</td>
<td>Class IIa</td>
<td>OFFP [216,241]</td>
<td></td>
</tr>
<tr>
<td>AS</td>
<td>Resuscitated VT/VE</td>
<td>Class Ia</td>
<td>C** [216,241]</td>
<td></td>
</tr>
<tr>
<td>HCM</td>
<td>Class Ib</td>
<td>B [216,241]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DCM</td>
<td>Class Ib</td>
<td>B [216,241]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RVC</td>
<td>Primary prevention</td>
<td>Class Ib</td>
<td>OFFP [216,241]</td>
<td></td>
</tr>
<tr>
<td>WPW</td>
<td>Class Ib</td>
<td>OFFP [216,241]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Reduced SCD, modest impact on total mortality. **As alternative to implantable defibrillators when the device is not implanted.


European Heart Journal (2001) 22, 1374-1493

Prevention By Amiodarone

<table>
<thead>
<tr>
<th>Disease</th>
<th>Setting</th>
<th>Recommendations</th>
<th>Level of evidence</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-MI</td>
<td>Primary prevention</td>
<td>Class Ia</td>
<td>A* [187,207-212]</td>
<td></td>
</tr>
<tr>
<td>Post-MI</td>
<td>Resuscitated VT/VE, spontaneous VT</td>
<td>Class Ia</td>
<td>C** [216,241]</td>
<td></td>
</tr>
<tr>
<td>AS</td>
<td>Revascularization</td>
<td>Class Ia</td>
<td>OFFP [216,241]</td>
<td></td>
</tr>
<tr>
<td>HCM</td>
<td>Class Ib</td>
<td>B [216,241]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DCM</td>
<td>Class Ib</td>
<td>B [216,241]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RVC</td>
<td>Primary prevention</td>
<td>Class Ib</td>
<td>OFFP [216,241]</td>
<td></td>
</tr>
<tr>
<td>WPW</td>
<td>Class Ib</td>
<td>OFFP [216,241]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

As alternative to implantable defibrillators when the device is not implanted.


European Heart Journal (2001) 22, 1374-1493

Conclusions

On the basis of our results, the routine implantation of a cardioverter–defibrillator cannot be recommended for all patients with nonischemic cardiomyopathy and severe left ventricular dysfunction. However, our findings of a reduction in sudden death from arrhythmia and an apparent benefit of ICDs in subgroup analyses suggest that the use of these devices should be considered on a case-by-case basis.
Factors Affecting Survival to Hospital D/C (OPALS study, n=5638)

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>Adjusted Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &lt;75</td>
<td>1.6 (1.2–2.3)</td>
</tr>
<tr>
<td>1st link early bystander access</td>
<td>4.4 (1.1–6.4)</td>
</tr>
<tr>
<td>2nd link early bystander CPR</td>
<td>3.7 (2.5–5.4)</td>
</tr>
<tr>
<td>3rd link Defibrillation&lt;8m</td>
<td>3.4 (1.4–8.4)</td>
</tr>
<tr>
<td>4th link early ACLS</td>
<td>1.1 (0.8–1.5)</td>
</tr>
</tbody>
</table>

Figure 1. Odds Ratios for Survival to Hospital Discharge Associated with Selected Factors.

The Role of Bystander CPR

Bystander CPR or Bystander Chest Compressions

Bystander CPR ⊖ prognosis due to coma & shock. (9% Success becomes 49% when they use AEDs).

EARLY DEFIBRILLATION

Introduction-VF Over Time

The relative value of early defibrillation (0-3m>70-90% success rate) exceeds the value of all medications, airway management & biphasic shock waves combined.

Figure 2. The Exponential Decline in the Rate of Survival after Sudden Cardiac Arrest as Time to Defibrillation Increases. Defibrillation alone often results in successful resuscitation if delivered within four minutes of cardiac arrest.
Value of Early CPR & Defibrillation

- VF Survival ≤ 7-10%/minute without defibrillation.

For any collapse to CPR interval (>12 minutes) survival <5%

Delay in defibrillation reduces survival. The curves represent the relation between collapse to CPR and defibrillation times. Each curve represents the probability of survival as a function of collapse to CPR interval (minutes). (Data from Thompson, et al. Circulation 1998; 98: 1617.)

Collapse To CPR minutes

<table>
<thead>
<tr>
<th>Collapse to Defibrillation Interval, min</th>
<th>≤ 5</th>
<th>&gt; 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival out of hospital cardiac arrest</td>
<td>5-7%</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>10-15% survive in-hospital arrest</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For any collapse to CPR interval (>12 minutes) survival <5%

NATURAL SOLUTION: TRAIN MORE BLS VOLUNTEERS & HAVE MORE DEFFIBRILLATORS AVAILABLE, BUT....

Use of Public AED for Prevention of SCD

Even if such exemplary programs were implemented on a widespread basis, the majority of victims of sudden death from cardiac causes — those who die at home — remain unprotected. The concept of therapy with AEDs at home, though attractive at first glance, remains unproven. In order to protect even the victims of cardiac arrest, people with an annual risk of approximately 2 percent would require intervention. In addition to the cost implications, community-based strategies could not be used and first responders would be limited to the people available in each home.
Table 3: Characteristics of the Out-of-Hospital Arrests of Cardiac Cause.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Arrest in Denotes Dead on Arrival without Knows Advance Directives</th>
<th>Arrest Treated by EMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of events</td>
<td>148</td>
<td>239</td>
</tr>
<tr>
<td>Public</td>
<td>9</td>
<td>167</td>
</tr>
<tr>
<td>Residential</td>
<td>139</td>
<td>72</td>
</tr>
<tr>
<td>Average interval</td>
<td>32.0</td>
<td>7.4</td>
</tr>
<tr>
<td>per unit — yr</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public</td>
<td>168.9</td>
<td>9.1</td>
</tr>
<tr>
<td>Residential</td>
<td>1.8</td>
<td>3.5</td>
</tr>
<tr>
<td>Total no. of arrests</td>
<td>121</td>
<td>121</td>
</tr>
</tbody>
</table>

Table 4: Characteristics of the Definite Out-of-Hospital Cardiac Arrests.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>CPR Only (N=107)</th>
<th>CPR plus AED (N=118)</th>
<th>P Value†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volunteer response</td>
<td>57 (53.8)</td>
<td>89 (76.5)</td>
<td>0.06</td>
</tr>
<tr>
<td>Bystander CPR — no. (%)</td>
<td>62 (60.2)</td>
<td>81 (68.4)</td>
<td>0.55</td>
</tr>
<tr>
<td>Shock delivered</td>
<td>2 (1.9)</td>
<td>4 (3.4)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Ventricular fibrillation or ventricular tachy</td>
<td>8.7±5.5</td>
<td>6.0±4.7</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Ventricular fibrillation or ventricular tachy cardia as first rhythm — no. (%)</td>
<td>43 (47.3)</td>
<td>71 (64.7)</td>
<td>0.66</td>
</tr>
<tr>
<td>Ventricular fibrillation or ventricular tachy cardia as first rhythm — no. (%)</td>
<td>43 (47.3)</td>
<td>71 (64.7)</td>
<td>0.66</td>
</tr>
<tr>
<td>Interval between call to EMS and first rhythm assessment — min ‡</td>
<td>5.6±1.4</td>
<td>5.7±1.3</td>
<td>0.63</td>
</tr>
<tr>
<td>Patient admitted to hospital — no. (%)</td>
<td>29 (27.1)</td>
<td>50 (42.9)</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Table 5: Number of Survivors of Out-of-Hospital Cardiac Arrest.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>CPR Only</th>
<th>CPR plus AED</th>
<th>P Value Unadjusted</th>
<th>P Value Adjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definite cardiac arrest — no.</td>
<td>107</td>
<td>128</td>
<td>0.09†</td>
<td>0.03‡</td>
</tr>
<tr>
<td>Residential units</td>
<td>37</td>
<td>33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public units</td>
<td>70</td>
<td>95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survivors of definite arrest — no.</td>
<td>35</td>
<td>30</td>
<td>0.05‡</td>
<td>0.63</td>
</tr>
<tr>
<td>Residential units</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public units</td>
<td>14</td>
<td>29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survivors of definite or uncertain arrest — no.</td>
<td>16</td>
<td>31</td>
<td>0.03‡</td>
<td></td>
</tr>
<tr>
<td>Cerebral performance category of survivors of definite arrest — no. (%)</td>
<td>10 (7.3)</td>
<td>22 (17.3)</td>
<td>0.95†</td>
<td></td>
</tr>
</tbody>
</table>

† Plus–minus values are means ±SD. EMS denotes emergency medical services.
‡ The P value was calculated by logistic regression analysis with covariates of the number of cardiac arrest, the sex, and the location (residential vs. public).
§ The P value was calculated by Fisher’s exact test.
¶ The P value was calculated by the test with rank test or Kendall’sTau test.
$ The P value was calculated by the test with rank test or Kendall’sTau test.
\$ The P value was calculated by the test with rank test or Kendall’sTau test.
|| The P value was calculated by the test with rank test or Kendall’sTau test.
** The P value was calculated by the test with rank test or Kendall’sTau test.
** The P value was calculated by the test with rank test or Kendall’sTau test.
*** The P value was calculated by the test with rank test or Kendall’sTau test.
**** The P value was calculated by the test with rank test or Kendall’sTau test.
***** The P value was calculated by the test with rank test or Kendall’sTau test.
****** The P value was calculated by the test with rank test or Kendall’sTau test.
******* The P value was calculated by the test with rank test or Kendall’sTau test.
******** The P value was calculated by the test with rank test or Kendall’sTau test.
********* The P value was calculated by the test with rank test or Kendall’sTau test.
********** The P value was calculated by the test with rank test or Kendall’sTau test.
*********** The P value was calculated by the test with rank test or Kendall’sTau test.
************ The P value was calculated by the test with rank test or Kendall’sTau test.
************* The P value was calculated by the test with rank test or Kendall’sTau test.
************** The P value was calculated by the test with rank test or Kendall’sTau test.
*************** The P value was calculated by the test with rank test or Kendall’sTau test.
**************** The P value was calculated by the test with rank test or Kendall’sTau test.
*************** The P value was calculated by the test with rank test or Kendall’sTau test.
***************** The P value was calculated by the test with rank test or Kendall’sTau test.
****************** The P value was calculated by the test with rank test or Kendall’sTau test.
******************* The P value was calculated by the test with rank test or Kendall’sTau test.
******************** The P value was calculated by the test with rank test or Kendall’sTau test.
********************* The P value was calculated by the test with rank test or Kendall’sTau test.
********************** The P value was calculated by the test with rank test or Kendall’sTau test.
*************** The P value was calculated by the test with rank test or Kendall’sTau test.
***************** The P value was calculated by the test with rank test or Kendall’sTau test.
****************** The P value was calculated by the test with rank test or Kendall’sTau test.
******************* The P value was calculated by the test with rank test or Kendall’sTau test.
******************** The P value was calculated by the test with rank test or Kendall’sTau test.
********************* The P value was calculated by the test with rank test or Kendall’sTau test.
********************** The P value was calculated by the test with rank test or Kendall’sTau test.
*************** The P value was calculated by the test with rank test or Kendall’sTau test.
***************** The P value was calculated by the test with rank test or Kendall’sTau test.
****************** The P value was calculated by the test with rank test or Kendall’sTau test.
******************* The P value was calculated by the test with rank test or Kendall’sTau test.
******************** The P value was calculated by the test with rank test or Kendall’sTau test.
********************* The P value was calculated by the test with rank test or Kendall’sTau test.
********************** The P value was calculated by the test with rank test or Kendall’sTau test.
*************** The P value was calculated by the test with rank test or Kendall’sTau test.
***************** The P value was calculated by the test with rank test or Kendall’sTau test.
****************** The P value was calculated by the test with rank test or Kendall’sTau test.
******************* The P value was calculated by the test with rank test or Kendall’sTau test.
******************** The P value was calculated by the test with rank test or Kendall’sTau test.
********************* The P value was calculated by the test with rank test or Kendall’sTau test.
********************** The P value was calculated by the test with rank test or Kendall’sTau test.
*************** The P value was calculated by the test with rank test or Kendall’sTau test.
WHAT IS THE ROLE OF EARLY ACLS?

In New England Journal of Medicine

ORIGINAL ARTICLE

12th AUG 2004

Advanced Cardiac Life Support in Out-of-Hospital Cardiac Arrest


Background
The Ontario Prehospital Advanced Life Support (OPALS) Study tested the incremental effect on the rate of survival after out-of-hospital cardiac arrest of adding a program of advanced life support to a conventional basic life support protocol.

Methods
This multicenter, controlled clinical trial was conducted in 17 cities before and after advanced life-support programs were instituted and enrolled 5638 patients who had had cardiac arrest outside the hospital. Of those patients, 1391 were enrolled during the rapid-defibrillation phase and 4247 during the subsequent advanced life-support phase. Paramedics were trained in standard advanced life support, which includes endotracheal intubation and the administration of intravenous drugs.

Table 1. Baseline Characteristics of the 5638 Study Patients in the 12-Month Rapid-Defibrillation and the 36-Month Advanced-Life-Support Phases.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Rapid-Defibrillation Phase (N=1391)</th>
<th>Advanced-Life-Support Phase (N=4247)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resuscitation---vs. total nos. (%)</td>
<td>1141 (82.3)</td>
<td>3571 (84.7)</td>
</tr>
<tr>
<td>First responder performed EMD in scene</td>
<td>401 (35.0)</td>
<td>1364 (32.3)</td>
</tr>
<tr>
<td>Advanced-life-support provider on scene</td>
<td>1902 (144.7)</td>
<td>501 (11.5)</td>
</tr>
<tr>
<td>Defibrillation shock---vs. no. (%)</td>
<td>1304 (90.9)</td>
<td>3556 (83.8)</td>
</tr>
<tr>
<td>Delivered by first responder</td>
<td>211 (19.7)</td>
<td>522 (12.3)</td>
</tr>
<tr>
<td>Delivered by EMD</td>
<td>416 (38.6)</td>
<td>1237 (29.1)</td>
</tr>
<tr>
<td>Subcutaneous adrenaline---vs. no. (%)</td>
<td>336 (24.6)</td>
<td>906 (21.3)</td>
</tr>
<tr>
<td>Attempted</td>
<td>3354 (99.0)</td>
<td>3556 (83.9)</td>
</tr>
</tbody>
</table>

Intravenous medications administered---vs. no. (%) | 1581 (95.3) | 3556 (83.9) |

Ephedrine | 1581 (95.3) | 3556 (83.9) |

Dosage | 1581 (95.3) | 3556 (83.9) |

Levophed | 582 (21.5) | 1237 (29.1) |

Dopamine | 1237 (29.1) | 1237 (29.1) |

Bicarbonate | 582 (21.5) | 1237 (29.1) |

Table 2. Survival and Functional Outcomes of Patients from the Two Study Phases.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Rapid-Defibrillation Phase (N=1391)</th>
<th>Advanced-Life-Support Phase (N=4247)</th>
<th>Absolute Increase (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROSC</td>
<td>200 (14.2)</td>
<td>76 (5.1)</td>
<td>5.1 (3.7 to 7.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Admission to hospital</td>
<td>52 (39.8)</td>
<td>623 (14.4)</td>
<td>3.7 (2.5 to 5.7)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Survival to hospital discharge</td>
<td>0 (0.0)</td>
<td>217 (5.1)</td>
<td>0.1 (0.1 to 0.1)</td>
<td>0.81</td>
</tr>
<tr>
<td>Survivors' cerebral performance score</td>
<td>54 (58.3)</td>
<td>141 (66.8)</td>
<td>0.7</td>
<td>0.17</td>
</tr>
</tbody>
</table>

Summary Health Index, Mark III, at 1 year | 0.6 | 0.7 | 0.1 |

| Interpretable median | 0.6 (0.3) | 0.6 (0.4) |

* CI denotes confidence interval, and dashes denote not applicable.
1 There were 68 survivors in the rapid-defibrillation phase, and 217 in the advanced-life-support phase.

ROSC & HOSPITAL ADMISSION: BUT HOSPITAL D/C SAME
Factors Affecting Survival to Hospital D/C (OPALS study, n=5638)

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>Adjusted Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &lt;75</td>
<td>1.5 (1.2–2.3)</td>
</tr>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; link early bystander access</td>
<td>4.4 (3.1–6.4)</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt; link early bystander CPR</td>
<td>3.7 (2.5–5.4)</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt; link Defibrillation&lt;8m</td>
<td>3.4 (1.4–8.4)</td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt; link early ACLS</td>
<td>1.1 (0.8–1.5)</td>
</tr>
</tbody>
</table>

Figure 1. Odds Ratios for Survival to Hospital Discharge Associated with Selected Factors.

CONCLUSIONS

The addition of advanced-life-support interventions did not improve the rate of survival after out-of-hospital cardiac arrest in a previously optimized emergency-medical-services system of rapid defibrillation. In order to save lives, health care planners should make cardiopulmonary resuscitation by citizens and rapid-defibrillation responses a priority for the resources of emergency-medical-services systems.

BLS & ACLS - no change

- **Responsiveness**
- Activate EMS & Call for AED/defibrillator
- CPR (ABC)-
- Defibrillate?
- Evaluate, Drugs & Airway protection

CONCLUSIONS

The goodness of fit for the model was 6.4 (P=0.00) and was assessed with the Hosmer-Lemeshow test. A reasonable fit can be assumed, since the result was not significant. The area under the receiver-operating-characteristic curve was 0.77, which indicates the validity of the model (a value of 1.0 represents 100 percent specificity and sensitivity). Odds ratios, determined after logistic-regression analysis, are for factors associated with survival to hospital discharge. CI denotes confidence interval.
### Phases of Cardiac Arrest

- **Electrical phase** (< 4 min) Defibrillate 1st - 70% success
- **Hemodynamic phase** (4-10 min) you must do chest compression and not shock 1st (Empty LV results in PEA 20 vs 4% survival in favor of chest compressions)
- **Metabolic phase** (>10m)

### What Should Be Done 1st CPR or Defibrillation?

- 200 pts. Out of hospital VF (Oslo Norway 1998-2001), age 70, 87% Male, observed 92%, bystander CPR 59%, collapse to ambulance arrival 12m
- Randomized to standard care (n=96) vs. CPR 1st for 3 min (n=104).
- PEP- survival to hospital discharge
- SEP- admission with ROSC
- Sub-analysis (prespecified) response time of >5m

L. Wik et al JAMA 2003; 289:1389-95

### Standard ACLS vs. CPR 1st

#### 1 year survival

- 1 year survival

L. Wik et al JAMA 2003; 289:1389-95

### ROSC according to ambulance response time.

- ROSC- according to ambulance response time.

L. Wik et al JAMA 2003; 289:1389-95

### ROSC (initially & finally) & PEA

- ROSC (initially & finally) & PEA


### 90 s CPR 1st vs. Immediate Defibrillation in Swine Model

- 30 swines 8 min untreated VF assigned to standard protocol vs. CPR 1st for 90 sec.
- PEP: ROSC (1st defibrillation & final)
- SEP: Good neurologic outcome, VF frequency.

VF Median Frequency

<table>
<thead>
<tr>
<th>VF TIME</th>
<th>Mean VF Frequency (Hz)</th>
<th>CPR</th>
<th>DF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1m</td>
<td>8</td>
<td>6.16</td>
<td>7.43</td>
</tr>
<tr>
<td>2m</td>
<td>8-9</td>
<td>6.09</td>
<td>7.38</td>
</tr>
<tr>
<td>3m</td>
<td>8-9</td>
<td>6.09</td>
<td>7.38</td>
</tr>
<tr>
<td>4m</td>
<td>8-9</td>
<td>6.09</td>
<td>7.38</td>
</tr>
<tr>
<td>5m</td>
<td>8-9</td>
<td>6.09</td>
<td>7.38</td>
</tr>
<tr>
<td>6m</td>
<td>8-9</td>
<td>6.09</td>
<td>7.38</td>
</tr>
<tr>
<td>7m</td>
<td>8-9</td>
<td>6.09</td>
<td>7.38</td>
</tr>
<tr>
<td>8m</td>
<td>8-9</td>
<td>6.09</td>
<td>7.38</td>
</tr>
<tr>
<td>9m</td>
<td>8-9</td>
<td>6.09</td>
<td>7.38</td>
</tr>
<tr>
<td>10m</td>
<td>8-9</td>
<td>6.09</td>
<td>7.38</td>
</tr>
<tr>
<td>11m</td>
<td>8-9</td>
<td>6.09</td>
<td>7.38</td>
</tr>
<tr>
<td>12m</td>
<td>8-9</td>
<td>6.09</td>
<td>7.38</td>
</tr>
</tbody>
</table>

Median VF Freq. 16.1+1.3 vs. 10.0+0.6 successful vs. unsuccessful ROSC (p<.0001)

Suggestions

- Prolonged VF (>5-8 min) mandates CPR prior to defibrillation.
- 90-180 sec CPR increased VF median frequency from 8 to 15 Hz and resulted in higher defibrillation success rate. (VF-Median frequency >12 predictor of ROSC)
- After a set of failed defibrillations maybe CPR time should be extended to 3 min (not 1 min)

Cobb LA, JAMA 1999;281:1182-88; Wik JAMA 2003; 289:1389-95

Conclusions

- Pre-countershock CPR after 8m VF improves immediate defibrillation outcome.
- 90 sec CPR increased VF median frequency from 8 to 15 Hz and resulted in higher defibrillation success rate. (VF-Median frequency >12 predictor of ROSC)
- This data is supported by other animal models and human research of Cobb* and Wik5.

Cobb LA, JAMA 1999;281:1182-88; Wik JAMA 2003; 289:1389-95

Chest Compression Only CPR

- If you are unwilling to do mouth to mouth breathing- chest compression only CPR is much better than doing nothing and actually as good as combined (chest compression & mouth to mouth breathing) CPR.
- Survival chest compression only BLS increased survival from 13 to 25% due to simplicity and lack of interference with chest compression (Arizona data). Half the time dedicated to ventilation (compression interference. 16 seconds/2 breaths)
- Many centers teach and advice bystander CC only.

RESPONSIVENESS
- ACTIVATE EMS & CALL AED / Crash cart
- AIRWAY (tilt chin, jaw thrust only)
- BREATHING (if Ø ⇒ 2 breaths)
- CIRCULATION (if Ø ⇒ chest compressions)
- FIBRILATOR / MONITOR

RAC-ABCD
Out of hospital BLS Protocol

Initial assessment

RESPONSIVENESS? Activate EMS, Call DF

RESPONSIVE?

- Activate EMS
- Call for Defibrillator/AED
- ABCD

POSITION
- B & C q-30-60s
- YES CIRCULATION
- 2 breaths

RESUSCITATION BREATHING
- (breath/ 5 s, C q-30-60s)

BP/ Position
- Pulse absent
- Chest compressions

Hx & PE
- Hx & PE

Transport & notify
- 100/m 4-5cm 15:2

Conditional AED Protocol

Responsive?
- Activate EMS, Call DF

Airway Devices *

- Bag mask ventilation with self inflating bag and cricoid pressure can be as effective as tracheal intubation for oxygenation, ventilation and prevention of aspiration for short ventilation periods (<15m) when used by skilled BLS providers (p-95)

- Unrecognized/incorrect esophageal intubation or tube dislodgment occurs in 8-25% of cases. (p-100)

- Tracheal intubation confirmation: Primary: PE, seeing tube pass via vocal cords, 5 point auscultation, bilateral chest expansion, tube condensation. Secondary: esophageal detector devices, end tidal CO2 detectors. (p-101)

- Use Manufactured tracheal tube holder: From prevention of tube dislodgment (p 101) and not strings & tapes.

- End tidal CO2 for detection of tube dislodgment. (capnometer single reading, capnography continuous reading) (p-101)

Basic Life Support (continued)

- Infant’s mouth-to-nose: equally effective to mouth-to-mouth/nose.

- Pulse check should not be taught to lay rescuers. (concern regarding time wasted and 10% incorrect assessment holding CPR & AED) instead will look for signs of ROSC (breathing & moving)

- Relief of FBAO (by blind finger sweep) not performed by lay rescuers in unresponsive victims. (<1% chokers, chest compressions as effective as abdominal thrusts in FBAO relief)

- Chest compressions location: in the center of chest “right between the nipples” FOR SIMPLICITY.

- Chest compression rate 100/m (not 80-100 for better BP & flow)

- Adult 1 & 2 rescuer Compression:Ventilation ratio is 15:2 [not 5:1(except PALS) less interruptions, less gastric aspiration]

- Basic Life Support (2001)

- Authorization to attach & activate AED by non-traditional responders (police, security, firemen & lay responders) remove state & local regulatory issues. (Early defibrillation for adult victims in public places has been reaffirmed, and exceeds the value of any other intervention)

- Special conditions for “phone fast” (1m CPR & phone) instead of “phone 1st”: near-drowning (submersion), choking, poisoning/ OD, Trauma, respiratory arrest, child.

- Bag Mask Ventilation: is a fundamental skill for all BLS providers.

- Smaller TV for mouth to mouth/mask ventilation: (400-600 instead of 800-1200) reduces risk of aspiration.
Airway Devices

- 4 New adult alternative airway devices:
  - Esophageal tracheal combitube (ETC) -IIa
  - Laryngeal mask airway (LMA) -IIa
  - Pharyngotracheal lumen airway (PTL)
  - Cuffed oropharyngeal airway (COPA)

LMA & ETC share:
- inserted blindly placed orally past oropharynx (not in trachea).
- protect from aspiration
- superior to bag mask technique in ventilation and oxygenation.
- almost equivalent to tracheal intubation (surprise?)

Traditionally BLS provider used bag-mask, and ACLS providers used tracheal intubation. The new guidelines support the optional use of ETC & LMA use for both BLS and ACLS providers.

PULSELESS VT / VF Primary & Secondary Survey

**RAC-ABCD**

<table>
<thead>
<tr>
<th>ShockX3 (200, 200-300, 360j) check rhythm &amp; Pulse</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PULSELESS VT/VF</strong></td>
</tr>
<tr>
<td><strong>ASYSTOLE</strong></td>
</tr>
<tr>
<td><strong>PEA</strong></td>
</tr>
<tr>
<td><strong>2nd ABC-DD Survey</strong></td>
</tr>
</tbody>
</table>

- VS - support: airway breathing BP HR & rhythm
- Re-attempt defibrillation/Reversible causes

Airway - E (LMA/ETC) confirmed & secured
Breathing (confirm ventilation & oxygenation)
Circulation (CPR IV line, assess HR & BP, drugs for BP DD: REVERSIBLE CAUSES)

Epinephrine or Vasopressin
Shock with 360j (150-200 biphasic)
Consider anti-arrhythmic Rx (Amiodarone, Lidocaine, Mg procainamide), buffers

CPR & drugs 3m

*NEVER INCORPORATED

Airway Devices

- 4 New adult alternative airway devices:
  - Esophageal tracheal combitube (ETC) -IIa
  - Laryngeal mask airway (LMA) -IIa
  - Pharyngotracheal lumen airway (PTL)
  - Cuffed oropharyngeal airway (COPA)

LMA & ETC share:
- inserted blindly placed orally past oropharynx (not in trachea).
- protect from aspiration
- superior to bag mask technique in ventilation and oxygenation.
- almost equivalent to tracheal intubation (surprise?)

Traditionally BLS provider used bag-mask, and ACLS providers used tracheal intubation. The new guidelines support the optional use of ETC & LMA use for both BLS and ACLS providers.

PULSELESS VT / VF Primary & Secondary Survey

**RAC-ABCD**

<table>
<thead>
<tr>
<th>ShockX3 (200, 200-300, 360j) check rhythm &amp; Pulse</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PULSELESS VT/VF</strong></td>
</tr>
<tr>
<td><strong>ASYSTOLE</strong></td>
</tr>
<tr>
<td><strong>PEA</strong></td>
</tr>
<tr>
<td><strong>2nd ABC-DD Survey</strong></td>
</tr>
</tbody>
</table>

- VS - support: airway breathing BP HR & rhythm
- Re-attempt defibrillation/Reversible causes

Airway - E (LMA/ETC) confirmed & secured
Breathing (confirm ventilation & oxygenation)
Circulation (CPR IV line, assess HR & BP, drugs for BP DD: REVERSIBLE CAUSES)

Epinephrine or Vasopressin
Shock with 360j (150-200 biphasic)
Consider anti-arrhythmic Rx (Amiodarone, Lidocaine, Mg procainamide), buffers

CPR & drugs 3m

*NEVER INCORPORATED

Regular Algorithm in ACLS

**Responsiveness**

**Activation Emergency System (101)**

**Crash Cart order Defibrillator/**

**Airway**

**Breathing (ventilation)**

**Circulation (chest compressions)**

**Defibrillation / Drugs / DD / Pacing**

**Evaluate CPR**

**Fail DD (SHS / STS)**

**Cardiogram / Color Pulse (pressure) Respiration / response**

Adrenaline

Atropine

Vasopressin (IIB to I)

Amiodarone (IIB)

Lidocaine (IIB)

Mg Sulfate

Procainamide (IIB)

Hypovolemia

Hypoxia

Hypothermia

Hyper/hypokalemia

Hydrogen

Tablets (OD)

tamponade

Tension PTX

Thrombosis acs/pv

**ATLS DRUGS**

**VT/ VF/ PEAS/ ASYSTOLE**

Adrenaline

Atropine

ADH (vasopressin)(IIB→I)

Amiodarone (IIB)

Lidocaine (IIB)

Mg Sulfate

Procainamide (IIB)

Circulatory Support:

Dopamine

Noradrenaline

Dobutamine

SVT:

Digoxin

Adenosine

Amiodarone

CCBs: diltiazem verapamil

Beta blockers

Anti-anginal:

Nitrates

Beta blockers

CCBs

**Advanced Cardiac Life Support**

- **Universal algorithm (ILCOR)** (for treating all 4 cardiac arrest conditions (VF, Pulseless VT, Asystole & PEA) in one algorithm) is adopted. (assuming most events are salvageable are pulseless VT/VF)

- **VF / Pulseless VT algorithm**. New guidelines changes. (Drug therapy {amines, anti-arrhythmics, buffers} less emphasized (IIB data))

  - Box 1: 4 conditions for phone fast (instead of phone 1st):
    - submersion/drowning, OD, Trauma, respiratory arrest.
  - Box 2: Place airway device ASAP (ETC, LMA or tracheal intubation) & confirm airway device placement.
  - Box 3: IV Epinephrine 1mg (?) Vasopressin 40u for refractory pulseless VT/VF. The most effective dose of E remains 1mg Q.3-5m. Higher doses are suspected to be harmful (neurological outcomes) & not more effective (should be rarely if ever used after failure with standard doze)
**ACLS: VF/ Pulseless-VT Algorithm (Fig 3.)**

- **Box 3: Vasopressin 40mg IV the new equivalent (IIb) to adrenaline 1mg (no scientific proof p146 ?) for refractory VF!**
- **Pulseless VT.** Tog of 10-20m allow single dose. (Adrenaline 1mg q-3-5m will be started in 5-10m if there is no response to Vasopressin.) 4th shock administered 30-60 seconds after A or V bolus.

**A. Amiodarone (300mg bolus! 2nd bolus 150mg!): added as 1st line antiarrhythmics for “shock refractory VF/VT”, (IIb) The alternative as 1st line drug is Lidocaine (1-1.5 mg/kg bolus may repeat q-3-5m up to 3mg/kg) or 2nd line procainamide.

**B. Bretylium- Eliminated.** Combination of ADE profile, delayed onset of action, and limited effectiveness eliminated Bretylium from ACLS protocols.

**C. Lidocaine- Still alternative for shock refractory VT/VF.** After being eliminated as arrhythmia prophylaxis in AMI over 8 years.

**D. Magnesium.** (1-2g IV) for 2 indications: Torsade de-pointes (IIb) and VT/VF or other arrhythmia with known or suspected hypomagnesemia (IIb).

**E. Procainamide.** (50 mg/mg up to 17 mg/kg) acceptable for VT & WCT but not recommended prolonged loading.

---

**Vasopressin (40 IU bolus)**

- **ADE: vasoconstriction ⇒ HTN, ischemia.**
- **Dose:** 40 u IV single bolus.
- **Not available on MICUs & hospital**
- **1 RCT* (double blind n=200) study showed no superiority over adrenaline (PEP: 1h/ hospital survival neuro-status).**
- **1 RCT showed survival benefit in out of hospital VF**


---

**Vasopressin (Theory)**

- **Human SCD survivors had higher Vasopressin levels than those who did not survive.**
- **↑ Cerebral & coronary blood flow & O2 delivery during SCD to improve outcome.**
- **Indications: shock refractory VT/VF, or septic shock. (not for PEA / asystole!!!!)**
- **Adrenaline like hemodynamic effects**


---

**RCT 33 centers Swiss/Austrian/German**

- 1186 patients randomized
- 33 Patients with missing study-drug code
- 1186 patients analyzed
- 589 vasopressin 40u IV q-3m X2
- 597 epinephrine 1mg q-3m X2
- 373 additional epinephrine
- 359 additional epinephrine
- **Comparison 1 (study drugs)**

**Comparison 2 (study drugs & epi)**

---

**The NEW ENGLAND JOURNAL of MEDICINE**

**A Comparison of Vasopressin and Epinephrine for Out-of-Hospital Cardiopulmonary Resuscitation**

Comparison 1 (study drugs)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Vasopressin Group (N=599)</th>
<th>Epinephrine Group (N=599)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spontaneous circulation restored with study drugs</td>
<td>42/262 (16.0)</td>
<td>45/284 (16.0)</td>
<td>0.87</td>
</tr>
<tr>
<td>Hospital admission</td>
<td>76/262 (29.0)</td>
<td>15/265 (23.0)</td>
<td>0.02</td>
</tr>
<tr>
<td>Hospital discharge</td>
<td>12/257 (4.7)</td>
<td>4/265 (1.5)</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Comparison 2 (study drugs & epi)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Vasopressin Group (N=599)</th>
<th>Epinephrine Group (N=599)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spontaneous circulation restored</td>
<td>62/387 (16.2)</td>
<td>93/311 (29.6)</td>
<td>0.02</td>
</tr>
<tr>
<td>Hospital admission</td>
<td>10/387 (2.6)</td>
<td>19/311 (6.1)</td>
<td>0.00</td>
</tr>
<tr>
<td>Hospital discharge</td>
<td>10/387 (2.6)</td>
<td>19/311 (6.1)</td>
<td>0.00</td>
</tr>
</tbody>
</table>

In conclusion, the effects of vasopressin were similar to those of epinephrine in the management of ventricular fibrillation and pulseless electrical activity, but vasopressin was superior to epinephrine in patients with asystole. The use of vasopressin followed by epinephrine may be more effective than the use of epinephrine alone in patients with refractory cardiac arrest.

Dramatic benefit in ROSC, hospital admission & d/c (outcomes OK)
Kudenchuck et al, NEJM 1999;341:871-78
Survival benefits was greatest if patients Receiving Amiodarone <16m from dispatch.

Amiodarone survival to hospital admission
Most benefit in those that were:
1) Found in VF patients that…
2) Had return of spontaneous circulation prior to amiodarone administration

Aniodarone vs. Lidocain in shock resistant VF
347 pulseless shock resistant VT/VF
Dispatch time <2m, drug (amiodarone 300mg) (½ received 2nd) @ time 25+8m
13/4(A) vs. 6.6(L) had ROSC prior to drug administration

Epinephrine
Atropine
PEA (1-4% survive)
RAC-ABC’”D”?

SECONDARY ABCD SURVEY
AIRWAY- place airway ASAP, confirm placement & secure
BREATHING- confirm oxygenation & ventilation, intubate
CIRCULATION: IV access, check rhythm & pulse, give meds for HR & BP
DD: 5Ts & 5Hs
Hypovolemia
Hypoxia
Hypothermia
Hypertension
Hypokalemia
H+- acidemia
EPINEPHRINE 1mg IV bolus Q-3-5m
ATROPINE 1mg IV bolus (if PEA slow)Q-3-5m (total<.04mg/kg<3mg)

No change
Problem
Epinephrine
Atropine

Controversies
Heart Controversies

Active compression decompresion- (plunger CPR) no survival in 2 RCT (n=1833) (not warranted)
High dose Adrenaline- 3 RCT (n=2704) ↑ return of spontaneous circulation, no ↑ survival & ↑ hospital D/C (HD not recommended)
Na Bicarbonate & Buffers- 1 RCT (n=502) no survival or hospital D/C benefits (use only for pre-existing metabolic acidosis, certain drug OD (ASA & TC), or hyperkalemia, agent of choice Na Bicarbonate).
Mouth to mouth ventilation- 1RCT (n=520) no ↑ in survival or hospital D/C if mouth to mouth ventilation done. (m to m ventilation not mandatory)
ACLS-PEAS & Asystole (cont)

- **Asystole** (fig. 5): Atropine Adrenaline & pacing still main treatment.
  - box 1- DNAR (look for advanced directive, living will 1-2% survive!)
  - box 3- Withhold or cease therapy (p-154) criteria developed for cease effort protocol (Confirm Dx by connecting gain f).
- Protocols for leaving body at the scene.
- Persisting asystole: (Document asystole for 5-10 m)
  1) Was intubation & ventilation achieved?
  2) Was VF adequately shocked?
  3) IV access & atroline & adrenaline given?
  4) Reversible causes checked & ruled out?

**SECONDARY ABCD SURVEY**

- **AIRWAY**: place airway ASAP, confirm placement & secure
- **BREATHING**: confirm oxygenation & ventilation intubate
- **CIRCULATION**: IV access, check rhythm & pulse, give meds for HR & BP
- **DD**: Ts & Shs

**TRANSCUTANEOUS PACING**

- **EPINEPHRINE** 1mg IV bolus Q-3-5m
- **VASOPRESSIN** 40μg-3mX2
- **ATROPINE** 1mg IV bolus Q-3-5m (total<.04mg/kg=3mg)

**ASYSTOLE PERSISTS**: CPR QUALITY?, ATYPICAL

"Asystole ..... Check me in another lead, & let's have TEA."

**STABLE MONOMORPHIC OR POLYMORPHIC VT**

**MONOMORPHIC**

- Normal HT, HF, normal LVEF
- **POLYMORPHIC**
- Normal HT, HF, low LVEF

**STABLE MONOMORPHIC OR POLYMORPHIC VT**

- **MONOMORPHIC**
  - Normal HT, HF, normal LVEF
  - **POLYMORPHIC**
  - Normal HT, HF, low LVEF

- **Amiodarone**
- **Sotalol**
- **Pronestyl**
- **Lidocaine**

- **Rx ischemia & K**
- **BB, Lido, Amio, Procain., Sotalol**

- **HF/ LVEF<40%**
- **Amio or Lido**
- **Synchronized D/C**

**Tachycardias**

- **Wide complex tachycardia** (regular & irregular).
- **Narrow complex tachycardia** (regular & irregular) (fig 7-9): selection of anti-arrhythmics based on hemodynamic stability, arrhythmia type, LVEF. Low threshold for cardioversion/defibrillation.
Post –Resuscitative Care (p-166)
- Active rewarming (mildly hypothermic patients) (IIb)
- Active hypothermia post arrest (?) investigated.
- Febrile hyperthermic patients- anti-pyretics (Ila)
- Hypo or hyperglycemia are detrimental.
- Hyperventilation reduces cerebral blood flow may harm and should be avoided unless brain herniation is imminent.
- Treat hypotension consider arrhythmic prophyaxis
- Aspiration prevention & Rx
- Revascularization?

Advanced Cardiac Life Support (cont)
- Stable VT- (polymorphic or monomorphic)
  - Amiodarone 1st line Procainamide 2nd
  - Lidocaine not 1st line
- Stable Wide complex tachycardia:
  - Amiodarone 1st, Sotalol IV 2nd (not available).
- AF (stable?/WPW?/ LVEF?/ >48h) considerations
- Narrow Complex SVT- (Dx & LVEF important for Rx)
  - Adenosine 1st line for AVNRT AVRT

Anoxic coma
- Cortex
- Basal ganglia
- Cerebellum
- Brainstem (categocephalic, cold caloric, dysconjugated gaze)

Best chance of recovery

<table>
<thead>
<tr>
<th>Time of exam</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 6 hours from onset</td>
<td>Pupillary light reflex present</td>
</tr>
<tr>
<td></td>
<td>GCS motor &gt; 1</td>
</tr>
<tr>
<td></td>
<td>Spontaneous EOM WNL</td>
</tr>
<tr>
<td>1 day</td>
<td>GCS motor &gt; 3 (flexor response or response to pain or suction)</td>
</tr>
<tr>
<td></td>
<td>GCS eye improved &gt; 1 from initial</td>
</tr>
<tr>
<td>3 days</td>
<td>GCS motor &gt; 3</td>
</tr>
<tr>
<td></td>
<td>Spontaneous EOM WNL</td>
</tr>
<tr>
<td>One week</td>
<td>GCS motor = 6</td>
</tr>
<tr>
<td>2 weeks</td>
<td>Oculocephalic WNL</td>
</tr>
</tbody>
</table>

Glasgow Coma Scale

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye Opening</td>
<td>Never</td>
<td>Pain stimuli</td>
<td>Te-Voice</td>
<td>Spont.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal Response</td>
<td>None</td>
<td>Unintelligible sounds</td>
<td>Inappropriate words</td>
<td>Confused</td>
<td>Oriented</td>
<td></td>
</tr>
<tr>
<td>Motor Response</td>
<td>None</td>
<td>Extensor response</td>
<td>Flexor responses</td>
<td>Withdraw from pain</td>
<td>Localize pain</td>
<td>Follow commands</td>
</tr>
</tbody>
</table>

@24h
**Improving neurologic outcome:**

- **Hypothermia (33°C - 1st 12h)** (PEP et al home or rehab vs no PEP on day 1 at 5:30; ILCP, glutamate [free radicals precursor], reduce ischemia.
- **Good medical therapy** (brain edema, ventilation, glucose, temperature, etc)
- **Hyperbaric Rx - No**
- **Corticosteroids - No**
- **Barbiturates (thiopental), Sedation, CCBs (nimodipine), Lidoflazine - No**
- **NOS inhibitors ? (in research)**
- **Baba Sali / Baruch water ?

*Bernard SA & 9 centers-European group NEJM -2002; 346: 549-563*

---

**Poor chance of recovery**

<table>
<thead>
<tr>
<th>Time</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 6 h</td>
<td>No pupillary light reflex present</td>
</tr>
<tr>
<td>1 day</td>
<td>GCS motor &lt; 4 (withdraw from pain) Spontaneous eye movements not orienting nor conjugate roving</td>
</tr>
<tr>
<td>3 days</td>
<td>GCS motor &lt; 4 (withdraw from pain) Spontaneous EOM not orienting nor conjugate roving</td>
</tr>
<tr>
<td>1 week</td>
<td>GCS motor &lt; 6 At &lt; 6h Spontaneous EOM not orienting nor conjugate roving</td>
</tr>
<tr>
<td>2 weeks</td>
<td>Oculocephalic not WNL At 3rd day GCS motor &lt; 6, GCS eye &lt; 4 2 week GCS eye not improved at least 2 points from initial</td>
</tr>
</tbody>
</table>

---

**Prediction of Neurological Outcome**

- **High degree of uncertainty.**
- **Those that recover have a good QOL**
  1. Brain death (brainstem areflexia + apnea) - (15%)
  2. Persistent unconsciousness (50%)
  3. Persistent disability(15%)
  4. Complete recovery (speech @ 24h) (20%)

---

**מתכנתים לקביעה מותו מוחי-חורר 1996**

1.اسبטה ביבשת ה فمن- והنم - הזר מוחי
2. חמשה תמותopersי מלכדי זוחל
3. חמשה תמותopersי מלכדי זוחל
4. מבויתות תמותopersי מלכדי זוחל

---

**מתכנתים לקביעה מותו מוחי-חורר 1996**

1.اسبטה ביבשת ה فمن- והنم - הזר מוחי
2. חמשה תמותopersי מלכדי זוחל
3. חמשה תמותopersי מלכדי זוחל
4. מבויתות תמותopersי מלכדי זוחל

---

** Prediction of Neurological Outcome**

- **High degree of uncertainty.**
- **Those that recover have a good QOL**
  1. Brain death (brainstem areflexia + apnea) - (15%)
  2. Persistent unconsciousness (50%)
  3. Persistent disability(15%)
  4. Complete recovery (speech @ 24h) (20%)
Circulatory & Ventilation Adjuncts (105-7)

- Plunger-CPR (IIb)-alternative to standard CPR
- Interposed abdominal compression CPR for in hospital CPR, (IIb)
- Vest CPR [alternative for hemodynamic support (6h) and standard CPR] (IIb)
- Mechanical piston CPR [alternative to standard CPR], (IIb)
- Direct cardiac Massage CPR (IIb) after failed standard CPR but less than 30m trial.

Toxicology

- Cocaine- ACS, CVA, HTN & arrhythmogenic
  - Avoid Beta-blockers (III) use nitrate 1st line (I) and benzodiazepines (IIa)
  - Alpha blockers may cause hypotension & arrhythmias and reserved to non-responders to nitrates & benzodiazepines.
- Tricyclic anti-depressants-Hypotension & V-arrhythmias
  - Induce systemic alkalemia 7.50-7.55 (IIa)
  - lidocaine (?) Procainamide (?)
- Opiates: respiratory failure- Mechanical ventilation before naloxone (IIa) will reduce catecholamines arrhythmias and pulmonary edema.

PALS

- Intraosseous access acceptable for age>6 (if IV not obtained in 3 attempts or 90 seconds.)
- Vagal maneuvers (especially ice water- diving reflex) added to Algorithm of narrow complex tachycardia that is hemodynamically stable, provided they do not delay adenosine or cardioversion if hypoperfusion occurs.
- Amiodarone (IV) added to algorithms of wide & narrow complex tachycardias & VF.
- AEDs for age>8, wt.>25.

Stroke (p204)

- tPA- within 3h of non-hemorrhagic stroke meeting fibrinolytic criteria (I). Use of the drug for patients with 3-6h from onset is not established (?)
- Stroke within 3h- EMS protocol & transfer to 24 h CT hospital, rapid hospital triage warranted (like MI), and ability to care for CVA patient.
- Prourokinase may have a role in stroke 3-6 h from onset (?)

Ethical Concerns in ACLS

- Family presence during CPR? (recommended provided it is done by planning, staff acceptance & designated staff members)
- DNAR (Do not attempt resuscitation [living will, advanced directive, anklet /bracelet] in field & hospital must be honored and doing otherwise is unethical & prohibited by law)
- Certification of death in the field (no transport for non-traumatic cardiac arrest victim who failed ACLS in field)
- Criteria for pronouncing the patient dead via telecommunication: Quality ACLS attempt with no response and no special conditions (hypothermia, toxic or drug overdose)
- Survivor support plans: Leaving the body, reporting death, support, obtaining death certificate, transfer to funeral homes,

REGULAR NARROW COMPLEX TACHYCARDIA (stable)

- Dx Maneuver: adenosine, CSM, Valsalva
- JUNCTIONAL: LVF=N
  - HF/LVF<40% - Amio, BB, CCB
  - CCB>BB-Dig-DC or Amio,Sot., Pron.
- PSVT (AVNRT, AVRT)
  - LVF=N
  - LVF<40% - Dig-Amio>Dil
  - CCB, BB, Amio
- Ectopic or MAT
  - LVF=N
  - HF/LVF<40% - Amio, Diltiazem

* Adapted from Resuscitation 2005 for Cardiopulmonary Resuscitation and Emergency Cardiac Care.
1. מה המשמעות של "shock refractory VF"?  
א. ברטליום  
ב. אטרופין  
ג. זוגרסיין  
ד. פורוסיטיל  
ה. מגנזיום

2. מה ה搬到 ניתן לתת במצב של Shock refractory VF?  
א. ברטליום  
ב. אטרופין  
ג. זוגרסיין  
ד. פורוסיטיל  
ה. מגנזיום

3. מה הפובר?  
א. חס על שלושה ת equipe בתינו  
ב. חס בין הנשמותהבהחייאה בסיס ית במב וגר  
ג. חזה רצוי הנו אחת לחמש  
ד. חזה על כל הנשמה  
ה. חזה על כל הנשמה

4. מה הפובר?  
א. חס על שלושה ת equipe בתינו  
ב. חס בין הנשמותהבהחייאה בסיס ית במב וגר  
ג. חזה רצוי הנו אחת לחמש  
ד. חזה על כל הנשמה  
ה. חזה על כל הנשמה

5. מה הפובר?  
א. חס על שלושה ת.enqueue בתינו  
ב. חס בין הנשמותהבהחייאה בסיס ית בمب וגר  
ג. חזה רצוי הנו אחת לחמש  
ד. חזה על כל הנשמה  
ה. חזה על כל הנשמה

6. מה הפובר?  
א. חס על שלושה ת.enqueue בתינו  
ב. חס בין הנשמותהבהחייאה בסיס ית בمب וגר  
ג. חזה רצוי הנו אחת לחמש  
ד. חזה על כל הנשמה  
ה. חזה על כל הנשמה

7. מה הפובר?  
א. חס על שלושה ת.enqueue בתינו  
ב. חס בין הנשמותהבהחייאה בסיס ית בمب וגר  
ג. חזה רצוי הנו אחת לחמש  
ד. חזה על כל הנשמה  
ה. חזה על כל הנשמה

8. מה הפובר?  
א. חס על שלושה ת.enqueue בתינו  
ב. חס בין הנשמותהבהחייאה בסיס ית בمب וגר  
ג. חזה רצוי הנו אחת לחמש  
ד. חזה על כל הנשמה  
ה. חזה על כל הנשמה

9. מה הפובר?  
א. חס על שלושה ת.enqueue בתינו  
ב. חס בין הנשמותהבהחייאה בסיס ית בمب וגר  
ג. חזה רצוי הנו אחת לחמש  
ד. חזה על כל הנשמה  
ה. חזה על כל הנשמה

10. מה הפובר?  
א. חס על שלושה ת.enqueue בתינו  
ב. חס בין הנשמותהבהחייאה בסיס ית בمب וגר  
ג. חזה רצוי הנו אחת לחמש  
ד. חזה על כל הנשמת  
ה. חזה על כל הנשמה

11. מה הפובר?  
א. חס על שלושה ת.enqueue בתינו  
ב. חס בין הנשמותהבהחייאה בסיס ית בمب וגר  
ג. חזה רצוי הנו אחת לחמש  
ד. חזה על כל הנשמה  
ה. חזה על כל הנשמה

12. מה הפובר?  
א. חס על שלושה ת.enqueue בתינו  
ב. חס בין הנשמותהבהחייאה בסיס ית בمب וגר  
ג. חזה רצוי הנו אחת לחמש  
ד. חזה על כל הנשמה  
ה. חזה על כל הנשמה

13. מה הפובר?  
א. חס על שלושה ת.enqueue בתינו  
ב. חס בין הנשמותהבהחייאה בסיס ית בمب וגר  
ג. חזה רצוי הנו אחת לחמש  
ד. חזה על כל הנשמה  
ה. חזה על כל הנשמה

14. מה הפובר?  
א. חס על שלושה ת.enqueue בתינו  
ב. חס בין הנשותהבהחייאה בסיס ית בمب וגר  
ג. חזה רצוי הנו אחת לחמש  
ד. חזה על כל הנשמה  
ה. חזה על כל הנשמה

15. מה הפובר?  
א. חס על שלושה ת.enqueue בתינו  
ב. חס בין הנשמותהבהחייאה בסיס ית בمب וגר  
ג. חזה רצוי הנו אחת לחמש  
ד. חזה על כל הנשמה  
ה. חזה על כל הנשמה
6. מה הće בכרו؟

<table>
<thead>
<tr>
<th>מספר</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. חפשו והצינעו בהיותם בינתוק ובין שניה בוערת. הצינעות 2-3 של היד הדימיניטות.</td>
</tr>
<tr>
<td>2. בכרתוקולים של התיאור בידיו אנמי איסור. להשתתף באימור.</td>
</tr>
<tr>
<td>3. התıntוק והיטב יוצר להיטוק והינתון להנשמה לפי. לאקפוף לא מומלץ להנשמה לפי לאף.</td>
</tr>
<tr>
<td>4. יתכן להשתתף בדריהוליזטר או בטוגמי בדום BLS במילה ויולבד מגיל 8 עד שעון 25 כ&quot;ש.</td>
</tr>
<tr>
<td>5. התחייבות עד עצום לה//================================================= נחלת ההצלה רכז. לאמורгин two טו פליי של מספר רוק.</td>
</tr>
</tbody>
</table>

תודה על תשומת הלב תודה על תשומת הלב !!!והצלחה!!!