Developments in Cardiopulmonary Resuscitation Guidelines

Bernd W. Böttiger

"To preserve human life by making high quality resuscitation available to all"
Outcome after CPR in Germany

*CPR following out-of-hospital cardiac arrest (36 months)

Böttiger BW et al., Heart 82:674-9, 1999
What is the hospital discharge rate following cardiac arrest of cardiac aetiology in Germany?

- 15 - 25 %
- 10 - 15 %
- 5 - 10 %
Outcome after CPR in Germany

350,000 unsuccessful CPR attempts/year in EU

*CPR following out-of-hospital cardiac arrest (36 months)

Böttiger BW et al., Heart 82:674-9, 1999
In-hospital CPR
Prospective US-study

Peberdy, Resuscitation 2003; Nadkarni, JAMA 2006
<table>
<thead>
<tr>
<th>Terms Searched</th>
<th>Funded Studies, n</th>
<th>Deaths per Year, n</th>
<th>Funded Studies per 10 000 Deaths per Year, n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Myocardial infarction</td>
<td>6886</td>
<td>157 000</td>
<td>439</td>
</tr>
<tr>
<td>Stroke</td>
<td>4403</td>
<td>150 000</td>
<td>294</td>
</tr>
<tr>
<td>Heart failure</td>
<td>9919</td>
<td>284 000</td>
<td>349</td>
</tr>
</tbody>
</table>
Table 2. Number of Research Projects Funded by the National Heart, Lung, and Blood Institute From 1985 to 2009

<table>
<thead>
<tr>
<th>SCIENCE + RESEARCH in cardiac arrest and CPR must be developed ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart arrest and resuscitation</td>
</tr>
</tbody>
</table>
CLOSED - CHEST CARDIAC MASSAGE

cardiac arrest. Using their newly discovered technique of closed chest compression, they successfully resuscitated 14 of the 20 patients. The authors write in their article: “Anyone, anywhere, can now initiate cardiac resuscitative procedures. All that is needed is two hands.”¹ Two months later at the annual meeting of the Maryland Medical Society, Kouwenhoven and Jude demonstrated the technique of chest compression and Peter Safar, MD, shared his data supporting the benefit of mouth-to-mouth ventilation. The 2 techniques were combined at that meeting, and modern CPR was born.
ERC 2005: „Main Issue: Compressions“

... to give ALL is the intervention that helps.

* Quality makes the difference

ERC, Resuscitation 67 Suppl 1:S1-S189, 2005
ILCOR, Resuscitation 67:181-341, 2005
www.erc.edu
Guidelines 2000 vs. Guidelines 2005

- ROSC: Resuscitation Survivors Compared
- Discharged: Patients Discharged
- VF: Ventricular Fibrillation
- Asystole: Asystolic arrest
- PEA: Pulseless Electrical Activity

Steinmetz et al., Acta Anaesthesiol Scand 2008
2010 - The Process:

International Consensus on Science & Treatment Recommendations (4 years)

277 questions / Worksheets
313 delegates / 30 countries

1. ILCOR Consensus
2. ERC Guidelines 2010
   18. October 2010

www.ilcor.org
www.erc.edu
"To preserve human life by making high quality resuscitation available to all"
2010: „Push hard and intensively... and with minimal pauses after defibrillation..."
Is effective CPR possible without ventilation?

Is ventilation interfering with cardiac output during CPR?
Compression (CC) + Ventilation vs. ‘Compression Only’

'Dorsph E, Wik L et al., Resuscitation 60:309, 2004'

'Compression only' is not useful after minutes.
Interruption of CPR for Ventilation: Negative Haemodynamic Effects of Pauses on CPP

Decision to start BLS:

- Person does not react & no normal breathing

Start with COMPRESSIONS …

Ventilation, if trained and willing to give …

Compressions : ventilation = 30 : 2 + AED

‘Compression only‘ fatal in case of:
longer CPR, asphyxia, children …

"Main Issue: Hard Compressions"
ALS in Adults (ERC 2010)

Start with 30 compressions

Compression : ventilation  =  30 : 2

Compression depth  5 - 6 cm  /  100 (- 120) / min

CPR until defibrillator is in place + charged

Avoid any interruptions  +  change every 2 min

“Main Issue: Hard Compressions”
ALS in Adults (ERC 2010)

Intubation of the trachea, if trained + alternatives

CapnoGRAPHY

Ventricular fibrillation (VF): 1x defibrillation

Series of 3 defibrillations only if during PCI or during/after cardiac surgery or witnessed and defibrillator immediately available

“Main Issue: Hard Compressions”
ALS in Adults – Dr. Bernd W. Böttiger

i.v. line, alternatively: intraosseus line

Adrenaline 1 mg / 3-5 min (in VF start after 3. defibr.)

Amiodarone 300 mg in ventricular fibrillation

Thrombolysis in suspected pulmonary embolism

„Lipid Resuscitation“ in case of LA-intoxication

“Main Issue: Hard Compressions"
SaO$_2$ = 94-98%

NNT = 6
ILCOR Advisory Statement

Therapeutic Hypothermia After Cardiac Arrest

ERC 2010: „... many of the accepted predictors of poor outcome ... are unreliable ... if the patient has been treated with hypothermia.“

ERC 2005: „... and children ...“
ERC 2010: „... and newborns ...“
The post-arrest treatment should start a.s.a.p.

**Cooling already during CPR?**

**Survival rate**
- Control: 34.4%
- RhinoChill: 43.5%

**Good neurology (CPC1/2)**
- Control: 17.6%
- RhinoChill: 25.0%

**Target temperature with RhinoChill**
- 207 min earlier ...

- **Survival rate**
  - All: 9/42 vs. 6/34 (RR=1.6, **p*=0.21)
  - CPR ≤ 10 minutes: 11/32 vs. 10/23 (RR=2.5, **p*=0.03)
  - VF: 6/21 vs. 8/16 (RR=1.8, **p*=0.18)
# Prognostic Factor PCI

## Table 5
Multivariate logistic regression analysis of prognostic factors for survival.

<table>
<thead>
<tr>
<th>Prognostic factors</th>
<th>Adjusted odds ratio</th>
<th>95% CI</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (per additional year)</td>
<td>0.96</td>
<td>0.94, 0.98</td>
<td>0.000</td>
</tr>
<tr>
<td>Response time (per additional min)</td>
<td>0.90</td>
<td>0.82, 0.98</td>
<td>0.027</td>
</tr>
<tr>
<td>Angiography/PCI</td>
<td>10.07</td>
<td>5.17, 19.61</td>
<td>0.000</td>
</tr>
<tr>
<td>Ambulance witnessed</td>
<td>5.06</td>
<td>1.21, 21.13</td>
<td>0.026</td>
</tr>
<tr>
<td>Initial VF</td>
<td>4.25</td>
<td>2.01, 8.98</td>
<td>0.000</td>
</tr>
<tr>
<td>Therapeutic hypothermia</td>
<td>4.11</td>
<td>2.14, 7.88</td>
<td>0.000</td>
</tr>
<tr>
<td>Cardiac aetiology</td>
<td>3.24</td>
<td>0.92, 3.44</td>
<td>0.074</td>
</tr>
<tr>
<td>Bystander witnessed</td>
<td>2.05</td>
<td>0.71, 5.90</td>
<td>0.182</td>
</tr>
<tr>
<td>Implementation of 2005 Guidelines</td>
<td>1.42</td>
<td>0.79, 2.57</td>
<td>0.244</td>
</tr>
<tr>
<td>Public location</td>
<td>1.11</td>
<td>0.59, 2.07</td>
<td>0.751</td>
</tr>
</tbody>
</table>

Prognostic factors that were found to be significant in preliminary univariate and bivariate analyses were included in this multivariate logistic regression analysis to detect independent factors potentially affecting survival in the shockable vs. non-shockable group. 95% CI: confidence interval. PEA: pulseless electrical activity. PCI: percutaneous coronary intervention.

*Olasveengen et al. Resuscitation 2009*
<table>
<thead>
<tr>
<th>Hypothermia (n = 40)</th>
<th>No hypothermia (n = 32)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-hospital</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reinfarction</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>At 6 months</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survival (%)</td>
<td>27 (68)</td>
<td>12 (38)</td>
</tr>
<tr>
<td>Survival with CPC 1 or 2 (%)</td>
<td>21 (53)</td>
<td>6 (19)</td>
</tr>
</tbody>
</table>

TVR = target vessel revascularisation; CPC = cerebral performance category.
ALS in Adults –
Compressions : ventilation  =  30 : 2

Compression depth = 5 - 6 cm / 100 - 120 / min
Capnographie / drugs

Mild therapeutic hypothermia
Coronary interventions – PCI
SOPs
ALS in Adults –

Hautsache her
Die neuen Leitlinien des European Resuscitation Council für Anästhesiologie und die Frequenz der Herzmasse hängen ausschließlich von der Qualität der Herzmasse ab. Der Eingriff muss so schnell wie möglich erfolgen, um die Überlebensrate zu erhöhen.

**HURTIGT**


**HÅRDET**

Tryk og hæve med mellemtryk på brystet, tag en pause så høj med placeringen. God hjertemassage er hårdt arbejde. Efter to minutter bør man være så udmattet, at man må holde pause eller afløses af en anden.

**HASTIGT**

God hjertemassage skal foregå i hurtig rytmefold med 100 tryk i minuttet eller mere. Tempoet varierer med raskt gang - eller til diskomusik. Et forsøg på University of Illinois har vist, at man giver bedre hjertemassage, hvis man lytter til Bee Gees »Staying Alive«.
We can save 100,000 lives per year in Europe

www.resuscitation2011.eu