Coronary Reperfusion After Cardiac Arrest

Tzong-Luen Wang
MD, PhD, FESC, FACC, FCAPSC
Chief, ED, Shin-Kong Wu Ho-Su Memorial Hospital
Professor, Medical School, Fu-Jen Catholic University
President, Society of Critical and Emergency Medicine
President, Taiwan Society of Disaster Medicine
CEO, National Resuscitation Council, Taiwan

Chain of Survival (AHA)

Immediate Recognition and Activation
Early CPR
Rapid Defibrillation
Effective ALS
Integrated Post-Cardiac Arrest Care

Chain of Survival (ERC)

Post-Cardiac Arrest Syndrome

Phases of Post-Cardiac Arrest Syndrome
- Immediate
- Early
- Intermediate
- Recovery
- Remodeling

Post-Cardiac Arrest Syndrome

Post-cardiac arrest syndrome: Epidemiology, pathophysiology, treatment, and prognostication. A Scientific Statement from the International Liaison Committee on Resuscitation; the American Heart Association Emergency Cardiovascular Care Committee; the Council on Cardiovascular Surgery and Anesthesiology; the Council on Cardiopulmonary, Perioperative, and Critical Care; the Council on Clinical Cardiology; the Council on Stroke.
Post-Cardiac Arrest Syndrome: Monitoring

1. General intensive care monitoring
   - Arterial catheter
   - Temperature control by pulse oximetry
   - Continuous ECG
   - CVP
   - SvO2
   - Temperature (bladder, esophagus)
   - Urine output
   - Arterial blood gases
   - Serum lactate
   - Blood glucose, electrolytes, CBC, and general blood sampling
2. More advanced hemodynamic monitoring
   - Cardiac output monitoring (arterial or non-invasive or RN catheter)
3. Cardiac monitoring
   - ECG, cardiac enzymes (continuously), early serum detection and treatment
   - CT/MR

Subsequent Post-Cardiac Arrest Care (AHA)

- Control body temperature to optimize survival and neurological recovery
- Identify and treat acute coronary syndromes (ACS)
- Optimize mechanical ventilation to minimize lung injury
- Reduce the risk of multi-organ injury and support organ function if required
- Objectively assess prognosis for recovery
- Assist survivors with rehabilitation services when required

Reperfusion in OHCA Survivors

- Fibrinolytics
- Acute Coronary Syndrome (AMI; STEMI)
- Pulmonary Embolism
- Primary PCI

Thrombolysis during OHCA Resuscitation

ORIGINAL ARTICLE

Thrombolysis during Resuscitation for Out-of-Hospital Cardiac Arrest

Thrombolysis during OHCA Resuscitation

Coronary Findings in OHCA Survivors (1)

Acute coronary-artery occlusion is frequent in survivors of out-of-hospital cardiac arrest and is predicted poorly by clinical and electrocardiographic findings. Accurate diagnosis by immediate coronary angiography can be followed in suitable candidates by coronary angioplasty, which seems to improve survival.
Coronary Findings in OHCA Survivors (2)

- A minority of OHCA patients has angiographic evidence of an acute coronary syndrome and one-third undergo PCI, but PCI is not an independent correlate of survival.
- The presence of ST elevation on admission was a strong independent correlate of acute myocardial infarction and may be used to triage OHCA patients to emergency angiography with a view to PCI.

Reperfusion in OHCA Survivors

- As most cardiac arrests are the result of thrombotic processes, such as AMI or PE, reperfusion with fibrinolysis or percutaneous intervention is one of the therapies of interest.
- There is increasing clinical evidence that this strategy might be relatively safe and beneficial.

Reperfusion in OHCA Survivors

- Rationale
  - Thrombotic Occlusion of Coronary Artery
  - AMI
  - Electrical Inhomogeneity
  - Micro-reentry Pathways for VF
  - VF
Reperfusion in OHCA Survivors

Difficulties

- In the setting of an arrest, chest pain and the presence of ST-elevation have been shown to be poor predictors of acute coronary occlusion. Conversely, the absence of these findings does not rule out an acute occlusion.
- Although Q-waves are often indicative of transmural ischaemia, they can represent acute as well as old myocardial infarction.


Myocardial damage in ST-elevation and non-ST-elevation myocardial infarction is normally reflected by elevated creatine kinase MB and troponin levels, which can only be measured after approximately 6 h.

A major limitation is that ventricular arrhythmias develop mostly within the first hour after an acute occlusion and cardiac enzymes or biomarkers are therefore typically negative.

Another problem could be that cardiac enzymes and markers may turn out to be positive due to chest compressions and defibrillation.


<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Design</th>
<th>Initial rhythm</th>
<th>Treatment</th>
<th>Creatine kinase MB</th>
<th>Troponin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hegermann</td>
<td>2006</td>
<td>Retrospective</td>
<td>Mainly ventricular fibrillation</td>
<td>Mainly ventricular fibrillation</td>
<td>21 vs. 21</td>
<td>81% vs. 71%</td>
</tr>
<tr>
<td>de Winter</td>
<td>2007</td>
<td>Retrospective</td>
<td>Mainly ventricular fibrillation</td>
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</tr>
</tbody>
</table>

Immediate PCI for OHCA Survivors

Immediate PCI for OHCA Survivors

- Successful immediate coronary angioplasty is associated with improved hospital survival in patients with or without ST-segment elevation.
- The use of immediate coronary angiography in patients with OHCA with no obvious noncardiac cause of arrest regardless of the ECG pattern is recommended.
In OHCA survivors who reached this hospital, the survival rate was high and the neurological outcome acceptable.

The use of therapeutic hypothermia is justified even in haemodynamically unstable patients and those treated with percutaneous coronary intervention.

In OHCA survivors, the survival rate was high and the neurological outcome acceptable. The use of therapeutic hypothermia is justified even in haemodynamically unstable patients and those treated with percutaneous coronary intervention.
Table 1: Outcome and adverse events in hypothermia and no-hypothermia groups of patients.

<table>
<thead>
<tr>
<th>Hypothermia (n=45)</th>
<th>No Hypothermia (n=32)</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Hospital</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resuscitation</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>VFA</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Cardiac arrest</td>
<td>32 (71)</td>
<td>26 (81)</td>
</tr>
<tr>
<td>Survival (71)</td>
<td>32 (71)</td>
<td>26 (81)</td>
</tr>
</tbody>
</table>

Primary PCI and MIH are feasible and may be combined safely in comatose survivors of ventricular fibrillation with signs of STEMI. Such a strategy may improve survival with good neurological recovery.
Standard Post-Resuscitation Protocol

<table>
<thead>
<tr>
<th>Prognostic factors</th>
<th>Adjusted odds ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention period</td>
<td>4.47</td>
<td>1.60–12.52</td>
</tr>
<tr>
<td>Age &gt; 70</td>
<td>0.48</td>
<td>0.17–1.37</td>
</tr>
<tr>
<td>Time to ROSC</td>
<td>0.91</td>
<td>0.85–0.96</td>
</tr>
<tr>
<td>Ambulance response time</td>
<td>0.91</td>
<td>0.78–1.07</td>
</tr>
<tr>
<td>Initial VF</td>
<td>1.84</td>
<td>0.33–10.41</td>
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</tbody>
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Based on a multivariate logistic analysis, hospital treatment in the intervention period was the most important independent predictor of survival.

Post-Cardiac Arrest Syndrome

- Barriers
  - Structural barrier
    - Resources, Organizational, Leadership, Scientific
  - Personal barrier
    - Intellectual, Poor Attitude
  - Environmental barrier
    - Political, Economical, Cultural
- Implementation
- TRM

Post-Cardiac Arrest Syndrome: Knowledge Gap

Summary

- In Taiwan, VF accounts for less than 15% of initial rhythm of OHCA victims.
- For each victim of AF, AMI should be considered as the most underlying etiology in Taiwan.
- Coronary reperfusion combined with other post-cardiac arrest care program should be considered each VF victim in Taiwan.