Predicting Neurologic Outcome after Cardiac Resuscitation

**Significance:**
- Resuscitation from cardiac arrest is often frustrated by failure of neurologic recovery.
- More than half of cardiac arrest survivors die in persistent coma or in a vegetative state, and the remainder often exhibit differing degrees of brain injury.
- Algorithms and indicators that predict poor prognosis are important tools in clinical decision making and discussions with colleagues and family.

**Prognostic Tools for Mortality:**
- The Glasgow Coma Scale (GCS) is the most universally used measure in the pre-hospital setting.
  -- A GCS of < 5 is considered the best cutoff for predicting mortality.
- The APACHE II score is the most common in-hospital predictor of mortality.
  -- An APACHE II score of < 19 is considered the best cutoff for predicting mortality.
- In a 2001 study by Grmec et al, APACHE scores < 19, GCS, < 5, and MEES score < 18 were compared and exhibited similar predictive capacities (80%, 82% and 78% respectively) for mortality.

**Prognostic Tools for Morbidity:**
- CPC scores (Cerebral Performance Category) are used by many studies to describe “good” and “poor” outcomes:
  1. CPC of 1-2 is “good”
  2. CPC of 3-5 is “poor”

<table>
<thead>
<tr>
<th>CPC Score</th>
<th>Definition</th>
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<tbody>
<tr>
<td>1</td>
<td>Conscious and alert with normal function or only slight disability</td>
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<tr>
<td>2</td>
<td>Conscious and alert with moderate disability</td>
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<tr>
<td>3</td>
<td>Conscious with severe disability</td>
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<tr>
<td>4</td>
<td>Comatose or persistent vegetative state</td>
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<tr>
<td>5</td>
<td>Brain dead or death from other causes</td>
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- Levy et al describe a series of 210 patients who suffered hypoxic-ischemic coma, 13% of whom regained independent function (CPC1-2) in the first year. A regression analysis generated rules to classify patients by likely outcome:
  - Initial exam/first 24 hours:
    - Absent pupillary reflexes at initial exam = no expected recovery of independent function
    - Predictors of potential return to independence (41% of patients developed CPC of 1 or 2)
      1. Initial presence of pupillary reflexes
      2. Development of roving eye movements that were conjugate or better
      3. Extensor, flexor, or withdrawal responses to pain
  - At 24 hours:
    1. “Poor” outcome patients exhibited either no movement or posturing and eye movements that were neither orienting nor conjugate. Only 1 of these patients regained independent function.
    2. 63% of patients who opened eyes, obeyed commands, or who had withdrawal or localizing response to pain showed significant recovery.
At 72 hours:

- A meta-analysis\(^3\) from 1966-1998 of studies describing neurologic outcomes and outcome predictors after CPR found the following predictors of outcome at 3 days post arrest:

<table>
<thead>
<tr>
<th>Test</th>
<th>Pooled Cases</th>
<th>Observed Predictive Value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>No motor response or extensor posturing to pain</td>
<td>150</td>
<td>100%</td>
<td>98-100%</td>
</tr>
<tr>
<td>GCS &lt; 5</td>
<td>73</td>
<td>100%</td>
<td>96-100%</td>
</tr>
<tr>
<td>No eye opening to pain</td>
<td>50</td>
<td>98%</td>
<td>96-100%</td>
</tr>
<tr>
<td>No pupillary light responses</td>
<td>29</td>
<td>100%</td>
<td>90-100%</td>
</tr>
<tr>
<td>Absent cranial nerve reflexes</td>
<td>55</td>
<td>96%</td>
<td>93-99%</td>
</tr>
</tbody>
</table>

Altering the outcome:

- In patients who have been successfully resuscitated after cardiac arrest from VT or VF, hypothermia protocols such as the one described 2/02 in NEJM can improve both neurologic outcomes and mortality by approximately 15%.

References:
3. Tweed, William. Predicting Poor Neurologic Outcome after Cardiac Resuscitation. Special communication, Dept of Anaesthesiology, King Faisal Specialist Hospital, Riyadh, Saudi Arabia.