OUTCOMES AFTER CARDIAC ARREST

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Learning Objectives

- Compare the outcomes of inpatient versus outpatient cardiac arrest patients
- Describe the long term consequences experienced by survivors of cardiac arrest

Outline

- How data is collected
  - Utstein definitions
  - National registries
- Outcome according to etiology
- Out-of-hospital vs in-hospital arrests
- Predictors of neurologically-intact survival
- Long-term outcomes
- Other post-resuscitation measures
- Summary

Utstein Definitions

- Nomenclature of cardiac arrest patients represented a problem in semantics
- Consensus definitions were created
  - 29 core data elements were identified and clearly defined
- Hospitals began using templates for standardized data collection


Out of Hospital Arrests

- Affect ~450,000 Americans annually
- 80% occur at home
- Overall 10% survival rate
  - More than 50% have permanent neurological disability

Out of Hospital Survival

- No significant difference in survival over time
  - 1977-1981 survival to hospital discharge: 17.5%
  - 1990-2001 survival to hospital discharge: 15.2%
- Long-term neurological outcomes are improving among patients who survive until discharge
  - Baseline improved from 1.6-2.8% of all patients with OOH arrest and "favorable neurological status"
  - From 2.1-4.3% for bystander witnessed arrest
  - From 9.8-20.6% for witnessed arrest with initial VF
Explanations
- Some aspects have improved
  - Bystander CPR
  - Decreased time to defibrillation
- Other features are more challenging
  - Increasing age
  - Decreased proportion of VF as initial rhythm
  - Response times slower
  - ? Population growth/urbanization

Outcomes According to Rhythm

<table>
<thead>
<tr>
<th>Out of Hospital</th>
<th>IN Hospital</th>
<th>N &gt; 50,000</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hypothesis</strong></td>
<td>% surviving</td>
<td>% surviving</td>
</tr>
<tr>
<td>Asystole</td>
<td>10</td>
<td>0-2</td>
</tr>
<tr>
<td>PEA</td>
<td>23</td>
<td>11</td>
</tr>
<tr>
<td>VT/VF</td>
<td></td>
<td>25-40</td>
</tr>
<tr>
<td><strong>Hypothesis</strong></td>
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<td>12</td>
<td></td>
</tr>
<tr>
<td>VT/VF</td>
<td>37</td>
<td></td>
</tr>
</tbody>
</table>

Outcomes from Noncardiac Causes
- Hemorrhage
- Infection
- Trauma
- Pulmonary embolism
- Near drowning

Examples
- Survived to discharge: 11%
- Neurologically functional: 6%

Predictors of Poor Neurological Outcomes
- Later initiation of CPR
  - CPR > 5 minutes
- Asystole or PEA
- Absence of vital signs
- Shock
- CVA
- Cancer
- Dementia
- Comorbidities

GO-FAR Score
- Based on massive registry in US hospitals
  - 366 hospitals participating
- Initially validated with > 50,000 patients with in-hospital arrest (2007-2009)
- Utilized 13 clinical variables in a scoring system
- Predicts likelihood of survival with good neurological function following arrest
- Cerebral Performance Category score (CPC) of 1

GO-FAR Clinical Variables
- Neurologically intact
  - Age
  - Major trauma
  - Acute stroke
  - Metabolic or hemolytic cancer
  - Septicemia
  - Medical noncardiac diagnosis
  - Hepatic insufficiency
- Admit from SNF
- Hypotension
- Respiratory insufficiency
- Pneumonia (active)
- Respiratory insufficiency
- Total of 11
GO-FAR Outcomes

<table>
<thead>
<tr>
<th>Group</th>
<th>Score range</th>
<th>% with CPC of 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very low</td>
<td>≥24</td>
<td>0.8</td>
</tr>
<tr>
<td>Low</td>
<td>14-23</td>
<td>2</td>
</tr>
<tr>
<td>Average</td>
<td>-5 to 13</td>
<td>9.2</td>
</tr>
<tr>
<td>Above average</td>
<td>≥15 to 6</td>
<td>27.8</td>
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</table>

Glasgow Outcome Scale

<table>
<thead>
<tr>
<th>Score</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dead</td>
</tr>
<tr>
<td>2</td>
<td>Vegetative state, no interaction with environment</td>
</tr>
<tr>
<td>3</td>
<td>Severe disability, cannot live independently</td>
</tr>
<tr>
<td>4</td>
<td>Moderate disability, participates in ADLs, but work/social life compromised</td>
</tr>
<tr>
<td>5</td>
<td>Good recovery; able to return to work</td>
</tr>
</tbody>
</table>

Learning Assessment Question

5. Long-term consequences of cardiac arrest include which of the following:
A. Decreased quality of life
B. Impaired functional status
C. Decreased cognitive function
D. All of the above

Post Resuscitation Challenges

- Severe global ischemia/reperfusion injury
  - Oxidative damage
  - Systemic inflammation
  - Myocardial stunning
  - Adrenal suppression
- Dysfunctional cerebral autoregulation

Post Resuscitation BP Management

5. Recent publication in CCM found MAP > 70 was associated with good neurological outcome
   - More driven by association between hypotension and poor outcome
   - Higher MAP thresholds not associated with more favorable neurological outcomes

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Avoid Hyperoxia

- Hyperoxia - defined as PaO2 ≥ 300
- Hyperoxia - post-arrest group had higher in-hospital mortality (63%)
- Normoxia group had 45% mortality
  - Hyperoxia mortality 57% (PaO2 < 60)
**Body Temperature**

- Increase in body temperature is associated with unfavorable neurological outcome
  - May exacerbate neural injury
  - Basis for therapeutic hypothermia
- Mild to moderate hypothermia (32-34°C)

**What Next?**

- If patient is comatose > 24 hours after cardiac arrest or hypothermia, the AAN guidelines can be used to assess prognosis:
  - Absence of brainstem reflexes - brain death testing
  - Myoclonic status epilepticus - poor prognosis
  - Serum NSE (neuron-specific enolase) > 33 - poor prognosis
  - Absence of pupil/corneal reflexes or absence of motor response > flexor - poor outcome

**Summary**

- Outcomes after cardiac arrest depend upon certain timely critical interventions:
  - Early defibrillation when appropriate
  - Effective CPR
- Quality improvement efforts should be data driven:
  - Large registries, updated guidelines
  - Outcomes remain in question
- Utilize tools to predict "favorable neurological outcomes" to help families make informed decisions