Comparison of OHCA occurring before and after paramedic arrival

Epidemiology, survival to hospital discharge and 12-month functional recovery

Authors:
Z. Nehme, E. Andrew, S. Bernard, K. Smith.

Department of Research & Evaluation, Ambulance Victoria
Background

1 in every 10 out-of-hospital cardiac arrest (OHCA) resuscitation attempts are witnessed by paramedics/EMS.

Despite immediate CPR and defibrillation by paramedics, international pooled survival to hospital discharge rates remain as low as 6.1%. (Sasson, 2010)

Some reports show higher survival rates in OHCA patients who receive immediate intervention by bystanders when compared to emergency rescuers. (Kaji, 2011)

Differences in patient characteristics, arrest aetiology, and quality of intervention provided by bystanders/EMS.
Methods

- **Objective**
  - To compare the epidemiology, survival and 12-month functional recovery outcomes of patients who arrest before and after paramedic arrival.

- **Design**
  - Retrospective analysis of adult (≥18 years) OHCA of presumed cardiac aetiology between July 2008 and June 2013, with an attempted resuscitation.
Methods

- **Setting**
  - Victoria, Australia (~5.7 million people)
  - Ambulance Victoria > 3,000 paramedics (ALS+MICA±FR)
  - In-field electronic data capture systems

- **Data Sources**
  - Case ascertainment by the Victorian Ambulance Cardiac Arrest Registry (VACAR) (> 75,000 OHCA cases)
  - Records data according to Utstein definitions
  - Hospital follow-up & disposition data
  - Since January 2010, 12 month QOL interviews
Methods

**Analysis**

- Primary outcome: Survival to hospital discharge
- Secondary outcome: Survival to 12 months with good functional recovery (GOSE ≥ 7)
- Patients stratified into 5 groups: Bystander witnessed ± bystander CPR; unwitnessed ± bystander CPR; and EMS witnessed.
- Outcomes assessed using logistic regression adjusted for: age, gender, public location, metropolitan region, and an initial shockable arrest rhythm.
- ‘Bystander witnessed + bystander CPR’ group was used as the reference category
## Results

Comparison of baseline characteristics across witnessed status groups (n=8,648)

<table>
<thead>
<tr>
<th></th>
<th>Bystander witnessed + CPR</th>
<th>Bystander witnessed no CPR</th>
<th>Unwitnessed + CPR</th>
<th>Unwitnessed no CPR</th>
<th>EMS witnessed</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Median age</strong></td>
<td>67</td>
<td>74</td>
<td>67</td>
<td>74</td>
<td>72</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td>73.3%</td>
<td>67.8%</td>
<td>66.3%</td>
<td>66.4%</td>
<td>64.7%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Median response time</strong></td>
<td>8.8</td>
<td>8.2</td>
<td>8.0</td>
<td>7.7</td>
<td>10.5</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Public location</strong></td>
<td>32.9%</td>
<td>15.0%</td>
<td>14.8%</td>
<td>7.5%</td>
<td>8.4%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Shockable rhythm</strong></td>
<td>59.7%</td>
<td>37.8%</td>
<td>24.4%</td>
<td>14.2%</td>
<td>41.5%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Survived to hospital</strong></td>
<td>46.0%</td>
<td>37.6%</td>
<td>20.4%</td>
<td>18.7%</td>
<td>53.4%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Survived to discharge</strong></td>
<td>21.1%</td>
<td>10.4%</td>
<td>5.9%</td>
<td>3.0%</td>
<td>34.9%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>12-month survival with GOSE ≥ 7</strong></td>
<td>56.4%</td>
<td>35.4%</td>
<td>58.1%</td>
<td>31.8%</td>
<td>58.9%</td>
<td>0.001</td>
</tr>
</tbody>
</table>
Results

Comparison of crude survival to hospital discharge outcomes by presenting rhythm
## Results

Impact of witnessed status on the risk-adjusted odds of survival to hospital discharge (n=8,460)

<table>
<thead>
<tr>
<th>Survival to hospital discharge</th>
<th>Odds Ratio (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bystander witnessed, bystander CPR</td>
<td>1.00 (Reference)</td>
<td>-</td>
</tr>
<tr>
<td>Bystander witnessed, no bystander CPR</td>
<td>0.76 (0.61 – 0.94)</td>
<td>0.011</td>
</tr>
<tr>
<td>Unwitnessed, bystander CPR</td>
<td>0.50 (0.39 – 0.64)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Unwitnessed, no bystander CPR</td>
<td>0.41 (0.28 – 0.58)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>EMS Witnessed</td>
<td>6.16 (5.04 – 7.52)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Model adjusted for: age, gender, public location, metropolitan region, and an initial shockable arrest rhythm.
Results

Impact of witnessed status on the risk-adjusted odds of 12-month survival with good functional recovery (GOSE ≥ 7) (n=5,734)

| Survival to 12 months post arrest with good functional recovery (GOSE ≥ 7) | 
|----------------------------------|------------------|
| Bystander witnessed, bystander CPR | 1.00 (Reference)  |
| Bystander witnessed, no bystander CPR | 0.44 (0.29 – 0.68) | <0.001 |
| Unwitnessed, bystander CPR | 0.62 (0.42 – 0.93) | 0.016 |
| Unwitnessed, no bystander CPR | 0.26 (0.12 – 0.57) | 0.001 |
| EMS Witnessed | 5.56 (4.18 – 7.40) | <0.001 |

Model adjusted for: age, gender, public location, metropolitan region, and an initial shockable arrest rhythm.
Results

Impact of witnessed status on the risk-adjusted odds of survival to hospital discharge in patients with an initial shockable rhythm (n=2,252)

<table>
<thead>
<tr>
<th>Survival to hospital discharge in cases with an initial shockable rhythm</th>
<th>OR</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bystander witnessed, bystander CPR, PAD used</td>
<td>1.00 (Reference)</td>
<td>-</td>
</tr>
<tr>
<td>Bystander witnessed, bystander CPR, no PAD used</td>
<td>0.65 [0.43 – 0.99]</td>
<td>0.043</td>
</tr>
<tr>
<td>EMS Witnessed</td>
<td>3.90 [2.45 – 6.20]</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Model adjusted for: age, gender, public location, metropolitan region.
Discussion

- **Key findings**
  - Despite earlier reports, survival from EMS witnessed arrests is higher than community-witnessed arrests
  - Risk-adjusted odds of 12 month survival with good functional outcome more than 5 times higher
  - Public health interventions:
    - 1) Focus on early activation of EMS after symptoms
    - 2) Increase PAD access
    - 3) Bystander CPR and short RTs
Discussion

- **Limitations**
  - Retrospective design
  - Arrest aetiology not verified through autopsy/medical records
  - 12-month GOSE outcomes were missing in 16.3% of patients who were lost-to-follow-up.
  - GOSE vs. other QOL instruments
Clinical Paper

Comparison of out-of-hospital cardiac arrest occurring before and after paramedic arrival: Epidemiology, survival to hospital discharge and 12-month functional recovery

Z. Nehme\textsuperscript{a,b,*}, E. Andrew\textsuperscript{a,b}, S. Bernard\textsuperscript{a,b,c}, K. Smith\textsuperscript{a,b,d}

\textsuperscript{a} Department of Research and Evaluation, Ambulance Victoria, Doncaster, Victoria, Australia
\textsuperscript{b} Department of Epidemiology and Preventive Medicine, School of Public Health and Preventive Medicine, Monash University, Prahran, Victoria, Australia
\textsuperscript{c} Intensive Care Unit, Alfred Hospital, Prahran, Victoria, Australia
\textsuperscript{d} Discipline of Emergency Medicine, School of Primary, Aboriginal and Rural Health Care, University of Western Australia, Crawley, Western Australia, Australia

\textbf{Abstract}

Background: Despite immediate resuscitation, survival rates following out-of-hospital cardiac arrests (OHCA) are unacceptably low. In rural Victoria, Australia, OHCA is usually managed solely by community First Responders (FR) before arrival of paramedics.