Drowning related out-of-hospital cardiac arrests: Characteristics and outcomes

Kylie Dyson¹,², Amee Morgans²,³, Janet Bray²,³, Bernadette Matthews⁴ & Karen Smith²,³,⁵

1. Operations Department, Ambulance Victoria
2. Department of Epidemiology and Preventive Medicine, Monash University
3. Research and Evaluation Department, Ambulance Victoria
4. Life Saving Victoria
5. Emergency Medicine Department, University of Western Australia

Contact: kylie.dyson@monash.edu
Introduction

• Major public health problem
• 388,000 annual drowning-related deaths worldwide
• Highest mortality in children & males
• Drowning can lead to cardiac arrest
• Requires prompt prehospital treatment for survival
• No Australian studies

Aims
• Characteristics of drowning-related cardiac arrest
• Independent predictors of survival
Aims & Methods

Setting
- Victoria (Australia), population 5.5 million

Included Cases
- Victorian Ambulance Cardiac Arrest Registry
- October 1999 - December 2011
- All ages

Analysis
- Univariate and multivariable
Results  All drowning-related OHCA cases

n=336 (1% of adult, 7% child OHCA)

71% Male

77% Adult
Results: All drowning-related OHCA cases

- **Public location**
  - Adults: 95%
  - Children: 64%

- **Witnessed**
  - Adults: 16%
  - Children: 19%

- **Bystander CPR**
  - Adults: 31%
  - Children: 66%
Results  All drowning-related OHCA cases

<table>
<thead>
<tr>
<th>Body of water</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocean</td>
<td>35%</td>
</tr>
<tr>
<td>Inland waterway</td>
<td>25%</td>
</tr>
<tr>
<td>Pool</td>
<td>17%</td>
</tr>
<tr>
<td>Bathtub, pond or bucket</td>
<td>16%</td>
</tr>
<tr>
<td>U/K</td>
<td>7%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Season</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td>45%</td>
</tr>
<tr>
<td>Winter</td>
<td>18%</td>
</tr>
<tr>
<td>Fall</td>
<td>24%</td>
</tr>
<tr>
<td>Spring</td>
<td>13%</td>
</tr>
</tbody>
</table>
Results  Cases receiving attempted EMS resuscitation

EMS resuscitation attempted

46%

- Younger
- Witnessed
- Bystander CPR

35%

84%

Adults

Children
### Results: Cases receiving attempted EMS resuscitation

<table>
<thead>
<tr>
<th>Category</th>
<th>Adults</th>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transported</td>
<td>44%</td>
<td>77%</td>
</tr>
<tr>
<td>Survived to hospital</td>
<td>26%</td>
<td>32%</td>
</tr>
<tr>
<td>Survived to discharge</td>
<td>5%</td>
<td>13%</td>
</tr>
</tbody>
</table>

- **Transported**: 58% of cases were transported to the hospital.
- **Survived to hospital**: 30% of adults and 26% of children survived to hospital.
- **Survived to discharge**: 8% of adults and 5% of children survived to discharge.
Results  Cases receiving attempted EMS resuscitation

Initial cardiac rhythm

- Asystole: 80%
- PEA: 13%
-VF: 7%

Survival

- 30%
- 20%
- 3%
Results  Predictors of survival

Survival to hospital discharge was associated with:

**Initial shockable rhythm**
- 30% vs. 6% (p< 0.05)
  - (AOR 48.70, 95% CI 3.80 to 624.86)

**Faster EMS response times**
- 6 vs. 8 minutes (p< 0.05)
  - (AOR 0.73, 95% CI 0.54 to 0.98)

**Non-saltwater drowning**
- 11/12 survivors had a non-saltwater drowning
  - (AOR 0.69, 95% CI 0.01 to 0.84)
Conclusion

• 8% survival
• Characteristics
  ➢ Male
  ➢ Summer
  ➢ Oceans & inland waterways
  ➢ Unwitnessed
• Predictors of survival
Recommendations

Prevention and improvement targets

• Males
• Warm seasons
• Children at home
• Adults at beaches, pools and inland waterways
• Child supervision
• Adults swimming alone
• ‘Chain of survival’
Clinical paper

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Kylie Dyson a,c,*, Amee Morgans b,c, Janet Bray b,c, Bernadette Matthews d, Karen Smith b,c,e

a Operations Department, Ambulance Victoria, Victoria, Australia
b Research and Evaluations Department, Ambulance Victoria, Melbourne, Australia
c Department of Epidemiology and Preventive Medicine, Monash University, Melbourne, Australia
d Life Saving Victoria, Melbourne, Australia
e Emergency Medicine Department, University of Western Australia, Perth, Australia

A B S T R A C T

Aim: There are few studies on drowning-related out-of-hospital cardiac arrest (OHCA) in which patients are followed from the scene through to hospital discharge. This study aims to describe this population and their outcomes in the state of Victoria (Australia).

Methods: The Victorian Ambulance Cardiac Arrest Registry was searched for all cases of OHCA with a precipitating event of drowning attended by emergency medical services (EMS) between October 1999 and December 2011.

Results: EMS attended 336 drowning-related OHCA during the study period. Cases frequently occurred in summer (45%) and the majority of patients were male (70%) and adult (77%). EMS resuscitation was attempted on 154 (46%) patients. Of these patients, 41 (27%) survived to hospital arrival and 12 (8%) survived to hospital discharge (5 adults [6%] and 7 children [12%]). Few patients were found in a shockable rhythm (6%), with the majority presenting in asystole (79%) or pulse-less electrical activity (13%). An initial shockable rhythm was found to positively predict survival (AOR 48.70, 95% CI: 3.80-624.86) while increased EMS response time (AOR 0.73, 95% CI: 0.54-0.98) and salt water drowning (AOR 0.69, 95% CI: 0.01-0.84) were found to negatively predict survival.

Conclusions: Rates of survival in OHCA caused by drowning are comparable to other OHCA causes. Patients were more likely to survive if they did not drown in salt water, had a quick EMS response and they were found in a shockable rhythm. Prevention efforts and reducing EMS response time are likely to improve survival of drowning patients.

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