Clinical Paper

Resuscitation of out-of-hospital cardiac arrests in residential aged care facilities in Melbourne, Australia

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A R T I C L E   I N F O

Article history:
Received 23 February 2011
Received in revised form 3 June 2011
Accepted 24 June 2011

Keywords:
Aged care facilities
Out-of-hospital cardiac arrest
Nursing homes
Elderly
Outcomes
Epidemiology

A B S T R A C T

Introduction: CPR in patients in residential aged care facilities (RACF) deserves careful consideration. We examined the characteristics, management and outcomes of out-of-hospital cardiac arrest (OHCA) in RACF patients in Melbourne, Australia.

Methods: The Victorian Ambulance Cardiac Arrest Registry (VACAR) was searched for all OHCAcs occurring in RACFs in Melbourne. The characteristics and outcomes were compared to non-RACF patients in the VACAR.

Results: Between 2000 and 2009 there were 30,006 OHCAcs, 2350 (7.8%) occurring in a RACF.

A shockable rhythm was present in 179 (7.6%) patients on arrival of paramedics of whom bystander CPR had been performed in 118 (66%); 173 (97%) received an EMS attempted resuscitation, ROSC was achieved in 71 (41%) patients and 15 (8.7%) patients survived to leave hospital. Non shockable rhythm was present in 2171 patients (92%) of whom 804 (37%) had an attempted resuscitation by paramedics. ROSC was achieved in 176 patients (22%) and 10 patients (1.2%) were discharged alive. Survival from OHCA occurring in a RACF was less than survival in those aged >70 years of age who suffered OHCA in their own homes (1.8% vs. 4.7%, p = 0.001). On multivariable analysis, witnessed OHCA (OR 3.0, 95% CI 2.4–3.7) and the presence of bystander CPR (OR 4.6, 95% CI 3.7–5.8) was associated with the paramedic decision to resuscitate.

Conclusion: Resuscitation of patients in RACF is not futile. However, informed decisions concerning resuscitation status should be made by patients and their families on entry to a RACF. Where it is appropriate to perform resuscitation, outcomes may be improved by the provision of BLS training and possibly AED equipment to RACF staff.

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1. Introduction

Cardiopulmonary resuscitation (CPR) has the goal of returning patients with out-of-hospital cardiac arrest to independent living. Therefore, CPR in patients in residential aged care facilities (RACF) requires careful consideration. As part of the advance care planning process, the decision to withhold CPR requires data on outcomes in this patient group. Ideally, the decision to withhold CPR should be an informed consensus plan made by the patient in collaboration with his/her physician and family members with consideration of the underlying condition and the chances of survival. There is little in the literature regarding outcomes of patients in residential aged care facilities who sustain cardiac arrest and none in the Australian setting.1–4 We therefore wished to characterize out-of-hospital cardiac arrests that occurred in residential aged care facility (RACF) patients and evaluate their outcomes.

2. Methods

The state of Victoria has a population of 5.3 million with approximately 4 million residing in metropolitan Melbourne. As of June 2008, 790 Residential Aged Care Facilities (RACF) across Victoria provided care to 44,770 Victorians.5 Residential aged care is provided for people who can no longer live independently at home.
due to frailty, disability and/or illness. Residential aged care facilities provide varying levels of support ranging from short-term care, referred to as respite care, low level care homes, formerly known as hostels, that provide accommodation and personal care and occasional nursing care and high level care homes, previously known as nursing homes, that care for people with a greater degree of frailty, who often need continuous nursing care. In Victoria residential aged care is provided by the not-for-profit sector (religious, charitable, local government and community-based groups), the private sector, and the Victorian Government (14.4% of places). It is subject to regulation principally by the Commonwealth Government under the Aged Care Act 1997. Compared to other nursing facilities there is a much higher proportion of a non-professional workforce. The EMS (Ambulance Victoria) comprises ambulance paramedics who have some advanced life support skills (laryngeal mask airway, intravenous epinephrine) and mobile intensive care ambulance (MICA) paramedics who are authorized to perform endotracheal intubation and administer a wider range of cardiac drugs. The Advanced Medical Priority Dispatch System is operational in Melbourne and provides telephone assistance facilitating bystander cardiopulmonary resuscitation (CPR) in cases of OHCA. MICA paramedics are dispatched to patients with critical illness, including patients with cardiac arrest. In addition, fire-fighters are dispatched to patients with suspected cardiac arrest in the inner two thirds of Melbourne's CBD area. EMS response time is the time from '000' call to paramedic's arrival at scene. The pre-hospital cardiac arrest protocols follow the recommendations of the Australian Resuscitation Council. Ambulance Victoria paramedics are not obliged to commence resuscitation when rigor mortis, decomposition or post mortem lividity is already present, where a refusal of treatment certificate has been completed for a current condition which most likely caused the cardiac arrest, where death has been declared by a Medical Officer who is or has been at the scene, where the presenting rhythm was monitored as asystole for >30s, and there has been >10 min downtime with no evidence of hypothermia, drug overdose or family/bystander objections. They may discontinue resuscitation if advanced life support has been performed for 30 min without return of spontaneous circulation (ROSC), the rhythm is not Ventricular Fibrillation or Ventricular tachycardia, there are no signs of life, no gasps or pupillary reactions and no evidence of hypothermia or drug overdose.

Since December 2007, all patients attended by paramedics have patient care data collected in an electronic patient record. Previous years involved a paper patient care record (PCR). Selected data from PCRs is collected from patients in cardiac arrest and stored on the Victorian Ambulance Cardiac Arrest Registry (VACAR). The VACAR also includes some data from the hospital record for those patients transferred to hospital, including hospital length of stay and survival to leave hospital. Results of hospital investigations were not available on VACAR for the time period involved in this study.

The Victorian Ambulance Cardiac Arrest Registry (VACAR) was searched for all OHCA occurring in residential aged care facilities, which were unattended by EMS.

4. Statistical analysis

All data were entered into an Access software cardiac arrest registry database (version 2003, Microsoft, Redmond, WA, USA). Statistical calculations were performed on STATA software (version 10.0 Stata Corporation, College Station, TX, USA). Chi-square analyses were used for categorical variables. Continuous variables were compared using the t-test (normal distribution) or Mann–Whitney (skewed distribution).

Factors affecting paramedic's attempting resuscitation in non shockable rhythm patients residing in aged care facilities were examined in a multivariable logistic regression analysis adjusting for Utstein variables. Separate analyses were performed for non shockable cardiac arrests in those aged over 70 years that occurred at home and in residential aged care facilities.

5. Results

Between 2000 and 2009 there were 30,006 OHCA, 2350 (7.8%) occurring in a residential aged care facility (RACF); this represented the second most common location of OHCA and was equal in proportion to those occurring in a street or public place. The proportion of OHCA attended at RACFs increased from 6.0% in 2000 to 10.3% in 2009 [OR 1.72 95% CI (1.42–2.07)].

**Table 1** is a modified Utstein template describing the characteristics of OHCA at RACFs and compares them to all adult OHCA. The table also compares OHCA occurring in RACFs to those occurring in the home in patients aged greater than 70 years. Shockable rhythm was present in 179 (7.6%) patients on arrival of paramedics of whom bystander CPR had been performed in 66% (n = 118); EMS attempted resuscitation in 97% (n = 173). ROSC was achieved in 71 patients (41%) and 15 (8.7%) patients survived to leave hospital. Pulseless electrical activity was present in 435 patients of whom 355 (82%) had an attempted resuscitation by paramedics. ROSC was achieved in 112 patients (31.5%) and 9 patients (2.5%) were discharged alive. Asystole was present in 1736 patients of whom 449 (26%) had an attempted resuscitation by paramedics. ROSC was achieved in 64 patients (14.3%) and 1 patient (0.2%) was discharged alive. Comparing OHCA characteristics for patients aged greater than 70 years of age who had an OHCA at a RACF with those that had an OHCA at home, more patients at the RACF had a witnessed OHCA (36% vs. 31%, p < 0.001), had bystander CPR (31% vs. 16%, p < 0.001) and an attempted resuscitation (42% vs. 38%, p < 0.05).

**Table 2** shows adjusted odds of paramedics attempting resuscitation increased with the OHCA being witnessed at both RACF and at home [OR 95% CI 2.9 (2.31–3.64) and OR 95% CI 10.16 (9–11.47), respectively] and with bystander CPR being performed [OR 95% CI 4.39 (3.46–5.57) and OR 95% CI 4.86 (4.19–5.63), respectively]. Table 3 examines factors associated with survival for non EMS witnessed OHCA where resuscitation was attempted by paramedics at a RACF; younger age and shockable rhythm OHCA were associated with increased adjusted odds of survival.

The number of days spent in hospital for patients who had an OHCA at a RACF and were transported with ROSC to hospital was one (0–3) median (IQR) while those that survived to hospital discharge back to RACF had a stay of median (IQR) 10.5 (5–19) days. There were 3 survivors (12%) who were discharged to a rehabilitation facility, the majority of survivors (n = 22) returning to the same level of facility from which they originated.

3. Ethics approval

VACAR has been classified as a quality assurance project by the ethics committee at the Department of Health. The collection of cardiac arrest data by VACAR was approved by the ethics committees of Melbourne hospitals receiving cardiac arrests by ambulance. This study was approved by the Research Committee of Ambulance Victoria and Monash University Human Research Ethics Committee.
Table 1
Modified Utstein template describing characteristics of OHCAs; all adults OHCAs are compared to all OHCAs occurring in RACFs. OHCAs occurring at RACFs and at home in adults over 70 years are compared.

<table>
<thead>
<tr>
<th>Utstein element</th>
<th>All adult OHCAs</th>
<th>RACF OHCAs</th>
<th>OHCA at RACF, adults &gt;70 years</th>
<th>OHCA at home, adults &gt;70 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absence of signs of circulation and/or considered for resuscitation</td>
<td>30,006 (100)</td>
<td>2350 (7.8)</td>
<td>1960</td>
<td>12,005</td>
</tr>
<tr>
<td>Age median (IQR) years</td>
<td>70 (52–80)</td>
<td>83 (75–88)</td>
<td>85 (70–89)</td>
<td>80 (75–84)</td>
</tr>
<tr>
<td>Female sex (%)</td>
<td>10,323 (34)</td>
<td>1189 (50)</td>
<td>1061 (54)</td>
<td>4754 (40)</td>
</tr>
<tr>
<td>Resuscitation attempted n (%)</td>
<td>13,063 (44)</td>
<td>977 (42)</td>
<td>820 (42)*</td>
<td>4569 (38)</td>
</tr>
<tr>
<td>First monitored rhythm n (%)</td>
<td>4485 (15)</td>
<td>179 (7.6)</td>
<td>152 (8)</td>
<td>1281 (11)</td>
</tr>
<tr>
<td>Shockable</td>
<td>20,248 (73)</td>
<td>1736 (74)</td>
<td>1416 (72)</td>
<td>9205 (77)</td>
</tr>
<tr>
<td>Non shockable</td>
<td>3098 (11.2)</td>
<td>435 (19)*</td>
<td>392 (20)*</td>
<td>1519 (13)</td>
</tr>
<tr>
<td>Arrest witnessed by non EMS personnel n (%)</td>
<td>8639 (31)</td>
<td>853 (36)</td>
<td>853 (36)</td>
<td>8639 (31)</td>
</tr>
<tr>
<td>CPR before EMS arrival n (%)</td>
<td>6333(23)</td>
<td>747 (32)</td>
<td>599 (31)*</td>
<td>1872 (16)</td>
</tr>
<tr>
<td>EMS response time Median (IQR) min</td>
<td>7 (6–9.5)</td>
<td>7.5 (6–10)**</td>
<td>7 (6–9)</td>
<td>7.9 (6–10)</td>
</tr>
<tr>
<td>EMS resuscitation time Median (IQR) min</td>
<td>30 (15–45)</td>
<td>29 (13–44)</td>
<td>29 (13–44)</td>
<td>31 (16–45)</td>
</tr>
<tr>
<td>Aetiology n (%)</td>
<td>22,564 (75)</td>
<td>2070 (88)**</td>
<td>1791 (91)</td>
<td>10,564 (89)</td>
</tr>
<tr>
<td>Resuscited</td>
<td>775 (2.6)</td>
<td>91 (3.9)</td>
<td>64 (3.3)</td>
<td>268 (2.2)</td>
</tr>
<tr>
<td>Neurological</td>
<td>182 (0.6)</td>
<td>15 (0.6)</td>
<td>6 (0.3)</td>
<td>17 (0.1)</td>
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<tr>
<td>Trauma</td>
<td>1376 (4.6)</td>
<td>9 (0.4)</td>
<td>4 (0.2)</td>
<td>67 (0.6)</td>
</tr>
<tr>
<td>Overdose</td>
<td>1526 (6.4)</td>
<td>33 (1.4)</td>
<td>3 (0.1)</td>
<td>41 (0.34)</td>
</tr>
<tr>
<td>Hanged</td>
<td>1229 (4.1)</td>
<td>19 (0.8)</td>
<td>8 (0.4)</td>
<td>95 (0.8)</td>
</tr>
<tr>
<td>Other</td>
<td>7954 (26)</td>
<td>113 (4.8)</td>
<td>84 (4.2)</td>
<td>953 (8)</td>
</tr>
<tr>
<td>Where resuscitation attempted n (%)</td>
<td>4416 (34)</td>
<td>247 (25)**</td>
<td>200 (24)</td>
<td>1445 (32)</td>
</tr>
<tr>
<td>Outcome</td>
<td>3713 (28)</td>
<td>204 (21)**</td>
<td>163 (20)</td>
<td>1204 (26)</td>
</tr>
<tr>
<td>Discharged from hospital alive</td>
<td>1105 (8.4)</td>
<td>25 (2.6)</td>
<td>17 (2.1)*</td>
<td>215 (4.7)</td>
</tr>
<tr>
<td>Missing hospital outcome data (n)</td>
<td>274 (2.1)</td>
<td>8 (0.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survival based on initial rhythm where resuscitation attempted n (%)</td>
<td>830/4452 (18)</td>
<td>15/173 (8.7)**</td>
<td>12/146 (8.2)</td>
<td>125/1265 (9.9)</td>
</tr>
<tr>
<td>VF/pulseless VT</td>
<td>78/5393 (1.4)</td>
<td>1/449 (0.2)**</td>
<td>1/361 (0.2)</td>
<td>24/1912 (1.3)</td>
</tr>
<tr>
<td>Asystole</td>
<td>196/3214 (6.1)</td>
<td>9/355 (2.5)**</td>
<td>5/313 (1.6)*</td>
<td>66/1392 (4.7)</td>
</tr>
</tbody>
</table>

* Chi² test p < 0.05 for OHCA occurring in RACF compared to all adult OHCAs.
** Mann Whitney test p < 0.05.
* Chi² test p < 0.05 for OHCA in adults over 70 years occurring at RACF compared to at home.

6. Discussion

Scientific evidence does not provide much guidance for end-of-life decisions in respect of cardiopulmonary resuscitation and to date there has been little available literature for clinicians, nursing staff or RACF managers to present to clients and their families when discussing end of life decisions and CPR. This study shows that OHCAs occurred in RACFs with increasing frequency through the decade, that outcomes were poor with survival rates 25% of similarly aged patients who sustained their OHCA in the home and that despite the RACF staff calling for an EMS response, bystander CPR was only performed in 32% of cases. This potentially reflects the increasing acuity of patients in RACF most with life-limiting conditions.

World wide life expectancy is increasing; Australia has the fourth highest life expectancy for men and women in the world. Those over 80 years, who are the primary users of residential aged care will increase by 14% to 2021 and 26.5% to 2016. As the population ages the RACF will be the place of care and site of death for a growing number of frail, older persons dying of chronic progressive illnesses.

The American Heart Association (AHA) guidelines on resuscitation state that "except in narrowly defined circumstances... professional first responders are expected to always attempt BLS [basic life support] and ACLS"; the most recent resuscitation guidelines reiterate the importance of imme-
Immediate chest compressions.14,15 Families may be distressed when there are attempts at resuscitation on patients who will likely not benefit from this treatment. In addition, there is a risk to EMS providers and the public when EMS responds with lights and sirens.16,17

The definition of medical futility has been considered as a survival rate of less than one percent18 although this has been debated.19-26 Survival rates in OHCA in RACFs in our study do not fall below this futility threshold with the exception of asystolic arrests where there was only one survivor. This is contrary to findings of Tresch et al.21 and Ghous et al.22 who found survival rates were similar for patients who experienced witnessed VF arrests in RACFs with those of other elderly people living in the community. They suggested that continued resuscitative efforts at RACFs be initiated only for patients with witnessed arrests and shockable rhythms. Applying such a rule in our population would have resulted in 10 of our 25 survivors not having a continued resuscitation.

Morrison et al.23 prospectively evaluated a clinical prediction rule to be used by emergency medical technicians (EMTs) trained in the use of an automated external defibrillator for the termination of basic life support resuscitative efforts during out-of-hospital cardiac arrest. This included OHCAs at all locations. The rule recommended termination when there was no return of spontaneous circulation, no shocks administered, and the arrest was not witnessed by emergency medical services personnel. Otherwise, the rule recommended rapid transportation to the hospital, in accordance with routine practice after completion of the basic life support/AED algorithm. Their rule had a specificity of 90.2% for recommending transport of survivors to the Emergency Department and had a positive predictive value for death of 99.5% and if implemented would decrease transportation to the Emergency Department to 37.4%.23 In our study, with ALS trained paramedics, non shockable, non EMS witnessed OHCA occurring in RACFs (n = 804) ROSC rates were 22%, the time taken to achieve ROSC was median (IQR) 29 (14–40) min and 10 patients (1.2%) were discharged from hospital alive. The reliability therefore of such clinical prediction rules may be questionable.

Despite an emphasis on advanced care planning in RACFs discussions to forgo CPR do not commonly occur.24 Older people, families, general practitioners, nurses, and RACF staff require support in undertaking difficult conversations regarding end-of-life care and ambiguity and uncertainty are often present.25 Shanley et al. recently performed qualitative interviews with managers from 41 residential aged care facilities. They found the majority of facilities did not have a systematic approach to advanced care planning, but tended to initiate discussions about end-of-life treatments late in a resident’s illness. They also found that these discussions were not always used in ongoing care planning and that the information was not always explicitly handed over to the hospital if the resident was transferred.26

Systematic implementation of an advance directive program in residential aged care facilities in other jurisdictions reduced health services utilization without affecting satisfaction or mortality.27 Standardized orders for limiting life sustaining treatments decrease the incidence of futile resuscitation attempts and should ensure that the patient’s wishes are honored.28 There are now procedural requirements in many countries regarding such orders,28 however, certain imperatives emerge; the instructions must be specific, detailed, easily understood, and transferable across health care settings. High nurse to patient ratios, the use of temporary sometimes inexperienced nursing staff combined with the widespread use of locum general practitioners27,28-31 in the provision of after hours medical care in RACFs mandate clear communication methods to ensure dignity, comfort and respect of the patients wishes be achieved and the default to inappropriate CPR be avoided.

The rate of bystander CPR administered in RACFs in this study was 32%, seemingly low for a location where health care professionals would be expected to perform CPR. This may be due to a number of factors; RACF staff may have thought it inappropriate to perform chest compressions and were calling emergency services simply for support in their decision or it may identify a lack of BLS training and/or education in the area of death and dying for RACF staff. If patients in RACFs are to have an attempted resuscitation then outcomes must be optimized. Better resuscitation is associated with better survival,32,33 functional status28 and health related quality of life.34-36 Recent work by Weisfeld et al.37 shows the application of an AED in communities is associated with nearly a doubling of survival after out-of-hospital cardiac arrest; in residential institutions where an AED was applied before EMS arrival the survival to hospital discharge was 5% compared to 2% where bystander CPR alone was utilized.

7. Limitations

This study has a number of limitations due to its retrospective nature. Pre-arrest health status, functional status and quality of life were not available. Currently our outcome measures of success for treatment of the elderly in OHCA are based on ROSC rates and survival, metrics for measuring the quality of death, the dignity offered to the dying patient and the quality of acute bereavement support for their families are lacking. Little is reported on quality of life outcomes for this age group of survivors in the literature. VACAR has commenced quality of life follow up of all OHCA survivors but these data were not available for the time periods described in this study. The extent to which advanced directives or standing orders influenced terminating the resuscitation is not clear and an important area for future research.

8. Conclusions

Outcomes from OHCA occurring in RACF are poorer than those occurring elsewhere. Informed decisions should be facilitated and documented between health care professionals, clients and their families on entry to a RACF regarding CPR within a comprehensive discussion on advance care planning. Where it is appropriate to perform resuscitation outcomes should be maximized by the provision of BLS/AED training and equipment to RACF staff.

Conflict of interest statement

There are no conflicts of interest to declare.

References


