

Out-of-hospital cardiac arrest registry: preliminary results from the Świętokrzyskie Province

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Introduction Cardiac arrest that occurs prior to hospital admission is defined as out-of-hospital cardiac arrest (OHCA).^{1,2} In the European registry, the annual rate of OHCA is estimated at 38.0–55.0 per 100 000 people.³ OHCA remains a major challenge for emergency services due to a very short time interval for the prevention of irreversible brain injury. Despite the availability of guidelines and therapies, the outcomes in OHCA survivors remain poor. The discharge ratio following OHCA ranges from 15% to 20% and has not improved in the last 30 years.^{4,5} In order to identify potential factors contributing to the survival rates in OHCA, a regional OHCA registry was launched in 2013. Until now, the prehospital phase has been analyzed.

Methods We retrospectively analyzed consecutive patients with OHCA registered between January 2013 and December 2016 in the Świętokrzyskie Province (area, 11 711 km²; population, 1.25 million; population density, 108/km²).⁶ Specialized teams were dispatched by default in response to a cardiac arrest call. When a team without a physician witnessed OHCA, cardiopulmonary resuscitation (CPR) was initiated and followed by the dispatch of a specialized team to help and decide on further management. Analyzed data from the ambulance patient care reports included the following variables: age, sex, time to arrival, first hearth rhythm, witnessed or unwitnessed collapse, and the final destination facility type (ie, percutaneous coronary intervention [PCI] or non-PCI center). The diagnosis of acute coronary syndrome or signs of heart failure or a shockable rhythm (ie, ventricular

fibrillation/ventricular tachycardia) were considered as cardiac etiology. The CPR success was defined as the return of spontaneous circulation.

Statistical analysis The quantitative variables were expressed as mean (SD) and the categorical variables as number (percentage). The Shapiro-Wilk and Kolmogorov–Smirnov tests were used to test for normality of distribution. The Kruskal–Wallis test was used to compare the differences in quantitative variables. Cross tabulations, using the χ^2 test of independence, were used to test the relationships of categorical variables. A *P* value of less than 0.05 was considered significant. Calculations were performed using MedCalc Statistical Software version 17.2 (MedCalc Software, Ostend, Belgium).

Results and discussion A total of 478 849 emergency services were dispatched in response to 1 667 507 calls. Of them, 353 537 (73.8%) were confirmed as emergency, out of which 2959 (0.84%) were OHCA. Forty four cases with incomplete documentation and 8 pediatric cases were excluded. Out of 2907 cases, 806 patients were found dead. In 2101 patients CPR was initiated with the success rate of 42.3%. The OHCA rate was 51.0 to 64.3 per 100 000 inhabitants, and CPR was performed in 34.7 to 45.4 per 100 000 inhabitants. The percentage of patients considered dead on the arrival of the emergency services ranged from 23.7% to 32.4%. The women-to-men ratio increased over the study period. The OHCA rate was higher in rural than in urban areas and was more frequently recognized by families than by lay

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TABLE 1 Patients characteristics from the registry data collected over 4 consecutive years

Variable	2013	2014	2015	2016	P value
All patients					
Number	755 (26)	741 (25.5)	785 (27)	626 (21.5)	–
Age, y, mean (SD)	66.8 (14.9)	68.1 (14.9)	67.9 (15.7)	68.3 (14.6)	NS
Time to arrival, min, mean (SD)	10.1 (6.3)	10.2 (6.1)	10.3 (6.1)	9.5 (5.9)	<0.05
Female sex	253 (33.5)	243 (32.8)	256 (32.6)	256 (40.5)	<0.05 ^a
Area					
Urban	241 (31.9)	244 (32.9)	257 (32.7)	277 (44.2)	<0.05
Rural	514 (68.2)	497 (67.1)	528 (67.3)	349 (55.7)	
Location of OHCA					
Home	621 (82.2)	594 (80.2)	621 (79.1)	487 (77.8)	NS
Other	134 (17.7)	147 (19.8)	164 (20.9)	139 (22.2)	
First eyewitness					
Family	622 (82.3)	582 (78.5)	618 (78.7)	478 (76.3)	<0.05
Other	133 (17.6)	159 (21.5)	167 (21.3)	148 (23.6)	
Dead on arrival	179 (23.7)	182 (24.6)	254 (32.4)	191 (30.5)	<0.05
Overall mortality	503 (66.6)	494 (66.7)	571 (72.7)	451 (72.0)	<0.05
Patients with CPR					
Number	576 (27.4)	559 (26.6)	531 (25.3)	435 (20.7)	–
Age, y, mean (SD)	66.1 (14.7)	66.9 (14.3)	66.4 (15.3)	67.8 (14.2)	NS
Time to arrival, min, mean (SD)	9.8 (6.3)	9.7 (6.0)	9.6 (6.1)	9.17 (5.7)	NS
Female sex	192 (33.3)	183 (32.7)	172 (32.4)	256 (39.1)	NS ^a
Witnessed					
Yes	110 (19.1)	146 (26.1)	123 (23.2)	171 (39.3)	<0.05
No	466 (80.9)	413 (73.9)	408 (76.8)	264 (60.9)	–
Cause of OHCA					
Cardiac	261 (45.3)	375 (67.1)	313 (58.9)	208 (47.8)	<0.05
Other	315 (54.7)	184 (32.9)	218 (41.0)	227 (52.2)	
Initial rhythm					
VT/VF	101 (17.5)	98 (17.53)	93 (17.51)	68 (15.6)	NS
Other	475 (82.5)	461 (82.5)	438 (82.5)	367 (84.4)	–
Transport destination					
CCU (PCI)	8 (3.2)	11 (4.4)	17 (7.9)	13 (7.4)	<0.05
ER	244 (96.8)	236 (95.5)	197 (92.1)	162 (92.6)	–
ROSC	252 (43.7)	247 (44.2)	214 (40.3)	175 (40.2)	NS

Data are presented as number (percentage) unless otherwise indicated.

a As compared with male sex

Abbreviations: CCU (PCI), coronary care unit with intention to primary percutaneous coronary intervention; CPR, cardiopulmonary resuscitation; ER, emergency department; NS, nonsignificant; OHCA, out-of-hospital cardiac arrest; ROSC, return of spontaneous circulation; VT/VF, ventricular tachycardia/ventricular fibrillation

bystanders. CPR was attempted more frequently in men. The time to arrival remained stable and ranged from 10.1 to 10.5 min. The majority of OHCA patients were found with a non-shockable rhythm and similar proportion of ventricular tachycardia and ventricular fibrillation. The number of witnessed arrests increased from 19.1% (2013) to 39.3% (2016). Likewise, the number of patients that were admitted directly into an intensive coronary care unit increased from 3.2% (2013) to 7.4% (2016) (TABLE 1).

We present the first report from our registry. Our study demonstrated that the initial CPR success rate remained unchanged over the 4 years despite the increasing number of witnesses and very short ambulance response time. Similar findings were reported from the prospective data analysis in 27 European countries in the EuReCa ONE study.³ In the OPALS (Ontario Prehospital Advanced Life Support) study (11 479 OHCA cases included), Safdar et al⁷ demonstrated that women who had OHCA were older than men, had fewer witnessed arrests, fewer initially shockable rhythms, and a lower bystander CPR rate. In the current study, 2300 emergency calls were made by nonfamily witnesses. In patients who were given CPR, the proportion of witnessed OHCA was low; however, it was constantly increasing over time. We demonstrated that witnesses were more frequently present on the scene, which may be associated with the education programs that were initiated on a large scale at the beginning of the study. The community readiness to respond to an emergency remains the key factor in determining survival from OHCA. In our study, while the percentage of witnesses increased, their presence had no significant effect on the CPR success. Unfortunately, in our registry, we were not able to identify whether the witnesses attempted resuscitation. This might be the reason for an increasing number of bystanders at the scene and a stable CPR success rate in our registry. Nadolny et al⁸ in the case-control study of 1603 OHCA patients demonstrated that the CPR success depends on the quality of procedures performed at the place of incident. Gach et al⁹ reported that in the population of 190 men and 82 women, a nonshockable rhythm and failure to initiate chest compression by lay bystanders were independent risk factors for prehospital death. Cebula et al¹⁰ demonstrated that witnesses in a rural setting were more likely to initiate bystander CPR and receive instructions from the EMS dispatcher compared with urban areas. In a study by Tsunoyama et al,¹¹ bystanders were reluctant to perform chest compression or to provide mouth-to-mouth rescue breathing primarily due to fear of litigation or the incorrect interpretation of the symptoms. Obviously, the year-to-year discrepancy in the number of witnesses observed in our study cannot be explained easily. According to the Swedish authors, Strömsöe

et al.¹² the witnessed OHCA ratio was highest in the low population density area with the lowest number of OHCA cases per year.¹² We could also speculate on changes in the socio-structural patterns, migration, education, increasing access to cell phones, educational school programs, and the availability of reality TV shows, etc. The number of emergency calls could also be affected by the family's knowledge about their relatives' chronic disease. This might also be in connection with the greater OHCA rate in the rural area. A highly diverse population density is supposed to be the main culprit. In our district, most of the population lives in a rural area as there are few cities. This mainly results from specific changes in the socioeconomic patterns and "city-to-suburb" migration. The high nonshockable rhythm rate may suggest that the shockable rhythms converted to nonshockable ones over time despite very short ambulance response time. This also might suggest that in an unknown proportion of patients, cardiac arrest could be considered "expected" as a natural consequence of a terminal disease, and thus the emergency call was not justified. Our data together with those from other countries warrant further widespread health education programs to enhance the use of basic CPR maneuvers by OHCA witnesses. In the Świętokrzyskie Province, live CPR demonstrations for the citizens have been frequently organized since 2013. We hope this will increase the public awareness and the readiness to respond. The main conclusion of this initial report is that the initial success of CPR remained unchanged over the study period despite the increasing number of witnesses.

ARTICLE INFORMATION

CONFLICT OF INTEREST None declared.

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