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The role of the witness of the incident and the role of the emergency medical dispatcher in out-of-hospital sudden cardiac arrest

Rola świadka zdarzenia i dyspozytora medycznego podczas wystąpienia pozaszpitalnego nagłego zatrzymania krążenia

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Keywords

sudden cardiac death, emergency medical dispatcher, resuscitation

Słowa kluczowe

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Conflict of interest

Konflikt interesów

None

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Summary

Introduction. Sudden cardiac arrest (SCA) is a serious medical condition that does not bode well. The incidence of SCA varies depending on location and time.

Aim. The aim of the research was to analyze the role of the witness of the incident and the role of the emergency medical dispatcher in cases of out-of-hospital SCA in the area controlled by the Voivodeship Rescue Service (VRS) in Katowice.

Material and methods. The analysis covered dispatch orders forms and emergency medical procedure forms of the VRS in Katowice collected in 2016 (N = 249 872). The retrospective analysis involved cases of out-of-hospital SCA in adults (N = 1603). Quantitative parameters were presented as average values with a standard deviation. Non-metric variables were described by means of proportion. A comparative analysis was performed by means of the Student's t-test for quantitative variables and the Pearson's chi-squared test for non-metric variables. The statistical significance adopted for the purpose of all analyses was < 0.05.

Results. There were 1005 male patients (62.7%), 566 female patients (35.3%), and 32 cases (2.0%) with no gender reported. Women were generally older (p = 0.000). The average age of the group was 65.7 years. Attack rate amounted to 59.37/100 000. SCA most frequently occurred in domestic conditions (p = 0.000), usually in the presence of a witness (p = 0.000). In 59.88% of the cases, first aid was provided by the witness of the incident. The most frequent action was chest compression (p = 0.000). A higher ROSC (return of spontaneous circulation) rate was observed in cases where a witness of the incident provided first aid according to phone instructions given (p = 0.008) and in the highest priority code, C-1 (p = 0.000). ROSC was reported in 33.4% of the cases.

Conclusions. Both the witness of the incident and the emergency medical dispatcher play a crucial role in SCA cases. The emergency medical dispatcher is the first element of the system of emergency medical services. Performing actions in accordance with current knowledge leads to a significantly higher ROSC rate.

Streszczenie

Wstęp. Nagłe zatrzymanie krążenia (NZK) jest poważnym i źle rokującym stanem medycznym. Jego występowanie jest bardzo zróżnicowane pod względem miejsca i czasu.

Cel pracy. Celem pracy była analiza roli świadka zdarzenia i dyspozytora medycznego w przypadkach pozaszpitalnego NZK w populacji objętej działalnością Wojewódzkiego Pogotowia Ratunkowego (WPR) w Katowicach.

Materiał i metody. Analizie poddano karty zlecenia wyjazdu oraz karty medycznych czynności ratunkowych WPR w Katowicach za rok 2016 (N = 249 872). Do badania retrospektywnego włączono przypadki pozaszpitalnego NZK u osób dorosłych (N = 1603). Parametry ilościowe przedstawiono jako wartości średnie wraz z odchyleniem standardowym. Zmienne niemetryczne opisano za pomocą wskaźników struktury. Analizę porównawczą przeprowadzono z wykorzystaniem testu t-studenta dla zmiennych ilościowych

oraz testu χ^2 Pearsona dla zmiennych niemetrycznych. Dla wszystkich analiz istotność statystyczną przyjęto na poziomie $< 0,05$.

Wyniki. Wśród badanych przypadków było 1005 mężczyzn (62,7%), 566 kobiet (35,3%) oraz 32 osoby (2,0%), dla których brak określenia płci. Kobiety zasadniczo były starsze ($p = 0,000$). Średnia wieku pacjentów wyniosła 65,7 roku. Współczynnik zapadalności wyniósł 59,37/100 000. Najczęściej do wystąpienia NZK dochodziło w warunkach domowych ($p = 0,000$), zazwyczaj w obecności świadka zdarzenia ($p = 0,000$). W 59,88% przypadków była prowadzona pierwsza pomoc przez świadków zdarzenia, najczęściej uciskanie klatki piersiowej ($p = 0,000$). Wyższy wskaźnik ROSC stwierdzono u pacjentów, u których były podejmowane czynności przez świadka zdarzenia przy instruktazu pierwszej pomocy przez telefon ($p = 0,008$) oraz w kodzie K-1 ($p = 0,000$). ROSC zanotowano w 33,4% przypadków.

Wnioski. Kluczową rolę w przypadkach NZK mają świadek zdarzenia oraz dyspozytor medyczny jako pierwszy element systemu ratownictwa medycznego. Prowadzenie działań zgodnie z aktualną wiedzą powoduje dużo wyższy wskaźnik ROSC.

INTRODUCTION

There have been significant changes in the Emergency Medical Services (EMS) in Poland in the last two decades. The factors determining the changes were: political transformations, the accession to NATO (1997) and to the European Union (2004). Nowadays, there are numerous regulations determining the scope of the system of Emergency Medical Services. The most important document is the Law of 8 September 2006 on State Emergency Medical Services that defines the rules of functioning of the system, its financing and organization. The act also refers to the regulations on first aid education (1).

An emergency medical dispatcher:

- shall have full legal capacity,
- shall have the qualifications required from EMS doctors, EMS nurses or paramedics,
- shall have at least 5 years of experience in providing medical services in emergency services, a hospital emergency department, an anesthesiology and intensive care unit or a hospital admission department.

Sudden cardiac arrest (SCA) is a serious medical condition that does not bode well. It occurs in unexpected situations without any evident symptoms preceding SCA. Cardiac arrest is a common reason of patients' death in Europe and the USA. SCA requires prompt reaction of both the witness of the incident and the emergency medical dispatcher. In Europe, SCA occurs in about 55-113/100 000 inhabitants per year (3, 4), whereas in the USA, the rate is even higher, amounting to 76/100 000 inhabitants per year. The differences may result from different diagnosis definitions and out-of-hospital SCA registers (5, 6). However, although there has been a visible increase in the survival rate in patients after out-of-hospital SCA, the overall mortality rate is still very high. Around 10.6% of patients survive hospital discharge (7). The witness of the incident plays a significant role: if they perform prompt chest compression and use an automated external defibrillator (AED), the return of circulation rate amounts to 59-76% (8, 9). The emergency medical dispatcher plays an important role in diagnosing SCA and instructing the witness of the incident on how to perform

cardiopulmonary resuscitation. His responsibility is also to identify the place of incident and deliver AED. The faster the arrival of a medical emergency unit, the sooner the advanced resuscitation procedures.

AIM

The aim of the research was to analyze the role of a witness of the incident and the role of an emergency medical dispatcher in cases of out-of-hospital SCA in the area controlled by the Voivodeship Rescue Service (VRS) in Katowice.

MATERIAL AND METHODS

The analysis covered dispatch orders forms and emergency medical procedure forms of the VRS in Katowice collected in 2016 ($N = 249\ 872$). The retrospective analysis involved exclusively cases of out-of-hospital SCA in patients over the age of 18 years. The diagnosis (sudden cardiac arrest, I46 (ICD-10)) was based on the international classification of diseases, ICD-10. The above criteria were fulfilled in 1603 cases, i.e. 0.64% of all incidents in the period in question.

The VRS in Katowice is the greatest public operator in Poland, taking care of 2.7 mln inhabitants of the Silesian province. The VRS teams are managed by 3 integrated medical dispatch centers located in Katowice (41 teams), Gliwice (25 teams) and Jastrzebie Zdroj (19 teams). Emergency medical dispatchers work in the integrated dispatch centers where they answer 999 calls and 112 calls redirected by the provincial authority. The VRS in Katowice has answered almost 620 000 calls and provided almost 250 000 interventions.

Demographic data of out-of-hospital SCA cases (gender, age, location) was analyzed in detail. In addition to this, the SCA attack rate and the SCA mortality rate were determined. The conversations between witnesses of incidents and emergency medical dispatchers were analyzed as far as first aid instructions were concerned.

Quantitative variables with normal distribution were presented by means of descriptive statistics parameters: average and standard deviation. Non-metric variables were demonstrated by means of proportions: sample size and sampling rate. Depending on the form of distribution, a comparative analysis was performed

by means of the Student's t-test for quantitative variables. Pearson's chi-squared test was applied in a comparative analysis for non-metric parameters. The statistical significance adopted for the purpose of all analyses was < 0.05 . STATISTICA 6.1 (Statsoft Inc.) and IBM SPSS 24.0 software was used to analyze data.

RESULTS

There were 1603 cases of out-of-hospital SCA in adults in the area controlled by the VRS in Katowice in 2016. Return of spontaneous circulation rate amounts to 33.4% (N = 546). The group under research consisted of 1005 (62.7%) male patients, 566 (35.3%) female patients and 32 cases (2.0%) with no gender reported. Women were generally older than men ($p = 0.000$). The cross analysis of gender and the particular dispatch center did not indicate any statistical significance ($p = 0.3888$).

The average age of patients with out-of-hospital SCA was 65.7 years (fig. 1). The cross analysis of age and the particular dispatch centers did not indicate any statistically significant differences ($p = 0.485$).

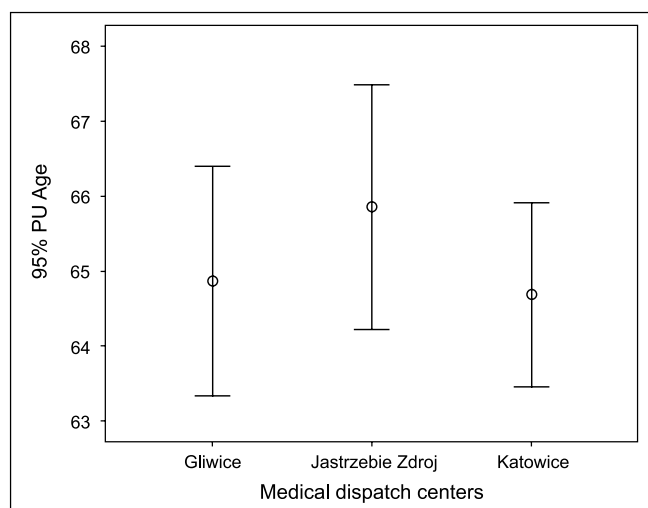


Fig. 1. The age of patients with out-of-hospital sudden cardiac arrest according to medical dispatch centers

The attack rate in out-of-hospital SCA cases in the population under research resulted in 59.37/100 000 inhabitants, and was twice as high in men (37.22/100 000) as in women (20.96/100 000). The attack rate was increasing with patients' age.

Most frequently, out-of-hospital SCA occurred in domestic conditions (N = 1136, 71.1%, $p = 0.000$). Further incidents occurred in public places (N = 234, 14.5%) and at schools (N = 1, 0.06%). SCA in male patients was more frequent away from home than at home ($p < 0.015$). The incident was usually witnessed by a third person (about 70% of cases, $p = 0.000$).

The most common reason of calling for EMS assistance and starting all EMS procedures was that the patient was unconscious (36.74%). Another numerous group were cases with reason classified as "other" (21.34%) where each of the cases constituted an individual case and a separate medical problem (tab. 1).

Tab. 1. Most common reasons of out-of-hospital SCA interventions

Intervention reason	Number of cases	Percent
Unconscious	589	36.74
Fainting	184	11.47
Chest pain	161	10.04
Dyspnea	121	7.54
Accident	75	4.67
Convulsions	68	4.24
Other	405	25.3

Out-of-hospital SCA occurred in the presence of a witness in 1065 cases (66.43%). Another 175 SCA cases (10.91%) were witnessed by the members of the emergency medical unit. Further cases (363, 22.66%) were not witnessed by any third person.

According to the emergency medical documentation and recordings of conversations between witnesses and medical dispatchers, medical rescue actions were performed by the witness of the incident in 785 cases, i.e. 48.97% of all SCA cases. Considering this number together with the 175 SCA cases (10.91%) witnessed by a member of the emergency medical unit, the resulting number of cases with medical rescue actions performed is 960 (59.88%). However, 643 patients with out-of-hospital SCA were not provided any assistance. It is worth noting that in 1240 cases witnessed by a third person (77.35% out of all 1603 cases), medical rescue actions were taken in 960 cases (i.e. 77.41% of cases with a witness). The most frequent action performed (865 cases: 90.1%, $p = 0.000$) was chest compression (indirect heart massage; fig. 2). A higher return of spontaneous circulation rate was observed in cases when any medical rescue action was performed at the place of the incident (ROSC in cases with actions taken: 35.1%, and ROSC in cases with no resuscitation performed: 30.94%, with a trend towards statistical significance ($p = 0.08$)) (fig. 3).

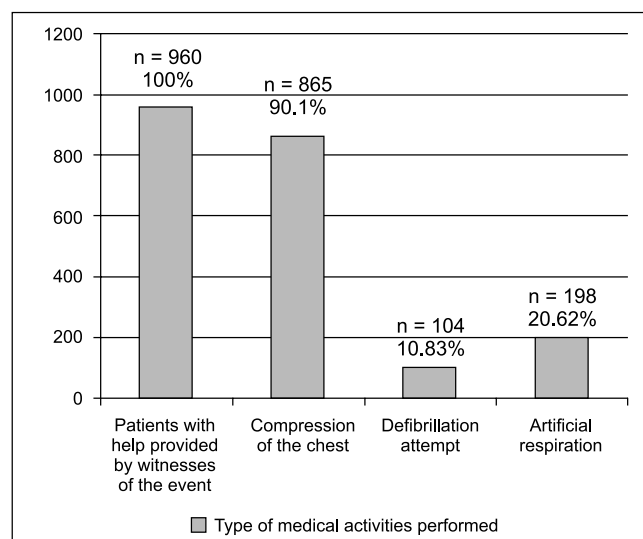


Fig. 2. Types of actions performed by the witness at the place of incident

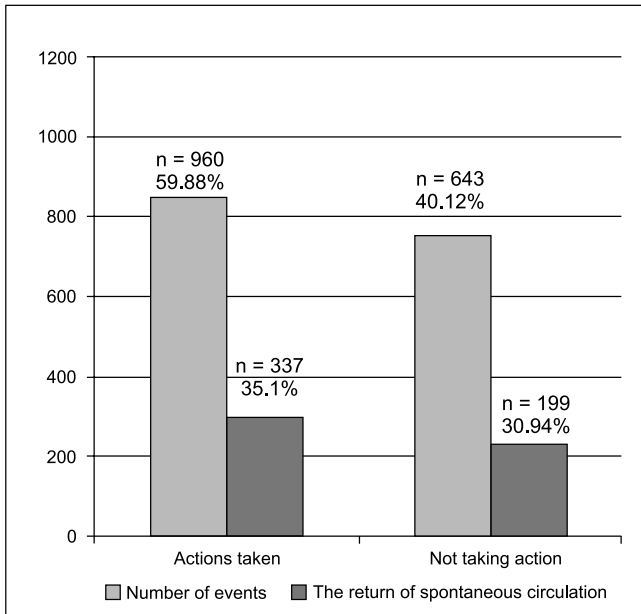


Fig. 3. Medical actions performed by the witness of the incident vs. return of spontaneous circulation

In Poland, the only indicator of the emergency medical system's quality is the median of time from team dispatch to team arrival at destination. Depending on the priority code of the incident, the average median of the highest priority code C-1 was 6 min 29 sec from dispatch to arrival at destination. C-1 is related with the use of light – and sound signals, and the time from dispatch to arrival at destination should be within 60 seconds. It is worth emphasizing that the time from dispatch to arrival in the case of the C-2 code (lower priority code) is much longer ($p = 0.000$). The time from dispatch to arrival at the place of incident in C-2 should be within 120 seconds. The use of light- and sound signals is not obligatory and depends on the medical dispatcher. The performance of advanced emergency medical procedures increases the survival rate in C-1 code (tab. 2). The use of defibrillation depending on the priority code was analyzed ($p < 0.001$) (tab. 3).

Tab. 2. A comparative analysis of variables for the C-1 priority code

Variable	Death	Survived	p
Age	64.938	63.638	NS
Age \geq 65 years	0.565	0.507	NS
Gender (male)	0.658	0.641	NS
Ventilation bag	0.579	0.648	$P < 0.05$
Intubation	0.480	0.591	$P < 0.0001$
Respirator	0.130	0.369	$P < 0.0001$
Defibrillation	0.193	0.313	$P < 0.0001$
Specialized unit	0.490	0.915	$P < 0.0001$
Time from the occurrence of the incident to arrival at destination (min)	7.470	8.035	$P < 0.05$
Localization (home)	0.701	0.721	NS
Time from dispatch to arrival up to 6-8 minutes	0.244	0.189	$P < 0.05$

NS – not statistical significant

Tab. 3. A cross-table: defibrillation vs. priority code

			Code		In total
			C-1	C-2	
Defibrillation	no	Number	1088	161	1249
		% of code	76.6	87.9	77.9
	yes	Number	332	22	354
		% of code	23.4	12.1	22.1
In total		Number	1420	183	1603
		% of code	100.0	100.0	100.0

In order to compare the outcomes of this research with other studies, the results have been presented according to the Utstein-protocol guidelines adopted by the Polish Resuscitation Council. The protocol was modified due to the selected sample of the analysis in question. The results refer exclusively to resuscitation performed as a part of pre-hospital care. The neurological condition of patients and the follow-up on patients' history one month after the incident were not included (fig. 4).

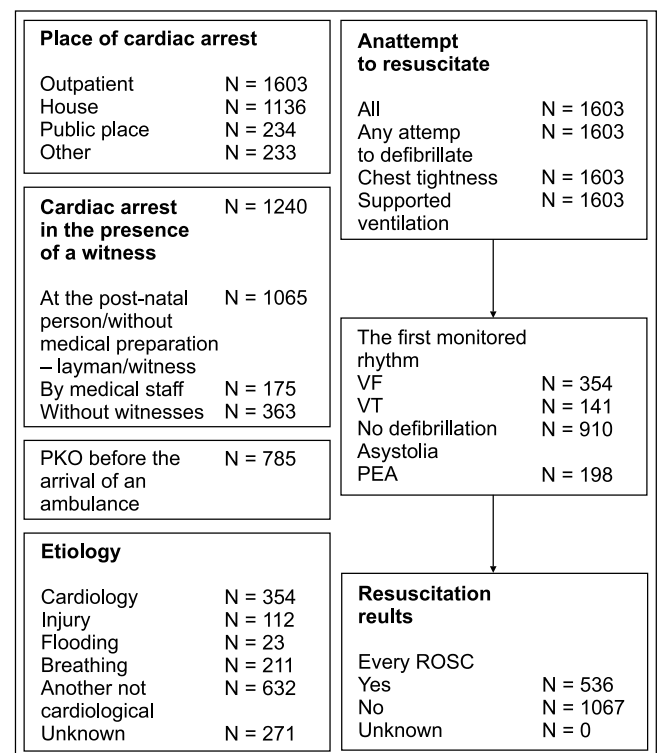


Fig. 4. Obtained results according to the Utstein protocol (as recommended by the Polish Resuscitation Council)

DISCUSSION

The objective of this paper was to introduce the role of the witness of the incident, and the role of the emergency medical dispatcher in out-of-hospital SCA. The 12-month research was conducted in the area controlled by the VRS in Katowice in 2016. There were 1603 SCA cases, which results in the attack rate of 59.4/100 000

inhabitants. On the one hand, some other countries report significantly higher indicators, e.g. 206/100 000 inhabitants in Austria (10) or 170/100 000 inhabitants reported by Gach et al. (11). On the other hand, the indicator amounts to 34/100 000 inhabitants in Denmark (12) and 51/100 000 inhabitants in Finland (13). The differences presumably result from various population characteristics and differences in collecting and reporting data (14). Pre-hospital SCA was twice as high in men as in women, which has been confirmed by other studies (15). The most frequent reason of starting EMS procedures was an unconscious patient, which, unfortunately, is not equal with cardiac arrest. Other reasons were: chest pain, dyspnea and fainting. Similar interventions can be found in the research by Møller et al. (16). In most SCA cases, the location of the incident is patient's home, and the incident is witnessed by a third person. Supposedly it is because SCA most frequently occurs in the elderly who suffer from various vascular diseases. The effectiveness of resuscitation depends to a large extent on the witness of the incident and the use of an AED (17, 18). The emergency medical dispatcher plays an important role here: it is the person who provides first aid instructions and often assist during the use of an AED (19, 20). According to the medical documentation and the analysis of the calls between witnesses of incident and medical dispatchers, the witness of the incident provided first medical aid in 60% of cases. In one of the publications about Beijing, China, witnesses provide first aid assistance only in 25% of cases (21). A low rate of resuscitation performed by witnesses of the incidents has also been

noted in some other publications (22, 23), also in a Polish research (24). The obtained results indicate that the probability of ROSC (return of spontaneous circulation) increases when the witness of the incident performs resuscitation (35.1 vs. 30.9%). Current recommendations suggest that the witness of the incident should perform only chest compression. The role of an emergency medical dispatcher in out-of-hospital SCA cases should be limited to providing first aid instructions on heart massage over the phone. Regardless of the circumstances of cardiac arrest, the longer the time between the loss of consciousness and resuscitation, the lower the chances of patient's survival. In the group under research, ROSC rate was 33.4% (N = 546). In Europe, ROSC rate amounts to 38.0% (14) on average. The result is close to the information provided by other sources (22, 25).

CONCLUSIONS

Out-of-hospital SCA incidence is sporadic in the context of all interventions in the period under research. However, out-of-hospital SCA cases are often unsuccessful. Performing actions in accordance with current knowledge leads to a higher rate of effective resuscitation in patients. Both the witness of the incident and the emergency medical dispatcher play a crucial role in SCA cases. The emergency medical dispatcher is the first element of the system of emergency medical services. Performing actions in accordance with current knowledge leads to a significantly higher ROSC rate.

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