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ANALYSIS OF SUCCESSFUL RESUSSITATION IN PRE–HOSPITAL STAGE IN UKRAINE

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The article presents a retrospective analysis of 384 cases of successful cardiopulmonary resuscitation at the prehospital stage in Ukraine. The study was conducted in the period from 2017 to 2019. The patients' general group was divided into two subgroups depending on the initial rhythm of sudden circulatory arrest: defibrillation and non–defibrillation rhythms. In each of the subgroups studied: age of patients, causes of sudden cessation of blood circulation, location, home care, time of resuscitation, methods of restoring airway patency, the presence of self–breathing in the post–resuscitation period, and level of consciousness. The subgroup with non–defibrillation rhythms included 199 cases (51.8%), the subgroup with defibrillation rhythms – 185 cases (48.2%). It was determined that the main cause of circulatory arrest in both subgroups was an acute coronary syndrome.

Keywords: sudden cardiac arrest, cardiopulmonary resuscitation, pre–hospital stage, emergency medicine care.

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АНАЛІЗ ВИПАДКІВ УСПІШНОГО ПРОВЕДЕННЯ СЕРЦЕВО–ЛЕГЕНЕВОЇ РЕАНІМАЦІЇ НА ДОГОСПІТАЛЬНОМУ ЕТАПІ В УКРАЇНІ

В статті наведено результати ретроспективного аналізу 384 випадків успішного проведення серцево–легеневої реанімації на догоспітальному етапі в Україні. Дослідження проводилось в період з 2017 по 2019 роки. Загальна група пацієнтів була розподілена на дві підгрупи залежно від початкового ритму раптової зупинки кровообігу: дефібриляційні та не дефібриляційні ритми. В кожній з підгруп вивчили: вік пацієнтів, причини зупинки раптової зупинки кровообігу, місце випадку, надання домедичної допомоги, час проведення реанімаційних заходів, методи відновлення прохідності дихальних шляхів, наявність самостійного дихання в післяреанімаційному періоді та рівень свідомості. В підгрупу з не дефібриляційними ритмами увійшло 199 випадків (51,8%), в підгрупу з дефібриляційними ритмами – 185 випадків (48,2 %). Визначено, що основною причиною зупинки кровообігу в обох підгрупах був гострий коронарний синдром.

Ключові слова: раптова зупинка кровообігу, серцево–легенева реанімація, догоспітальний етап, екстрена медична допомога.

Sudden cardiac arrest (SCA) remains a pressing and significant problem in today's medicine. The number of cases of SCA remains consistently high worldwide and tends to increase steadily due to the prevalence of the cardiovascular disease in all age groups. Thus, the number of cases of SCA in the US is about 500 thousand every year. In England, 30 thousand, on average, in the EU, the number of cases is 51–55 per 100 thousand populations [1, 4]. For a detailed analysis of all cases of SCA in countries with developed EMD systems, "registers of cases of SCA" are widely introduced [7]. One of the crucial indicators, which is determining on their basis, is the level of successful CPR in the prehospital stage and the final results of the treatment this group of patients. On average, the number of discharged patients without severe neurological

complications who underwent cardiopulmonary resuscitation (CPR) in the prehospital stage is from 8 to 10%. This number, according to researchers, is not a sufficient level [1, 3, 6, 8]. That is why, as the analysis of scientific research has shown, the search for effective measures aimed at increasing the number of CPR at the prehospital stage and improving the final results of treatment of patients with SCA [5, 9, 11]. The obtained results of data analysis allow constant improvement of both CPR protocols and the implementation of individual, organizational decisions. For example, improving the scheduling process, developing an affordable defibrillation program, etc. [3, 9].

The level of successful CPR at the prehospital stage in the EU is from 20 to 40% [4, 11]. Studies have identified the factors that influence the successful conduct of CPR. These include the time of onset of CPR and its quality, the provision of home care before the arrival of the EMD team, the initial rhythm, and the cause SCA. The chances of successful resuscitation and subsequent survival of the patient with SCA are much higher in defibrillation rhythms – ventricular fibrillation (VF) and ventricular tachycardia without a pulse (VT) [1, 7].

At present, Ukraine continues to reform the system of emergency medical care (EMC), aimed at improving the quality of care for patients and victims, including patients with IBD. It would be correct to use the scientific approach and experience of countries where such systems operate successfully. At this moment, there is no possibility to conduct a systematic analysis of cases of RCC and successful cases of CPR in Ukraine. This is primarily due to the lack of an appropriate register and the correct collection of information. That is why we have introduced the collection of data on the successful conduct of CPR at the prehospital stage. This paper presents the results of its initial analysis.

The purpose of the study was to perform a general analysis of cases of successful cardiopulmonary resuscitation in case of sudden cardiac arrest in Ukraine.

Materials and methods. To study the level of successful CPR at the pre–hospital stage in Ukraine, we used some indicators contained in the 22 forms of the annual report of the regional centers of emergency medical care for 2017 – 2019.

Also, for a detailed analysis of cases of successful CPR at the pre–hospital stage used retrospective analysis of reports on a specially developed in the State Institution "Ukrainian Research and Practice Center for Emergency Care and Disaster Medicine of the Ministry of Health of Ukraine" form of information collection, which contains the following indicators: who performed cardiopulmonary resuscitation – medical or paramedic; age and sex of the patient; causes of sudden cessation of blood circulation; place of incident – at home, on the street, in the car EMD, at work; conducting pre–medical care before the arrival of the EMD team – chest pressure, artificial respiration, use of an automatic external defibrillator (AED); total time of cardiopulmonary resuscitation; the first recorded rhythm of circulatory arrest – defibrillation rhythms (ventricular fibrillation (VF), ventricular tachycardia without pulse (VT) and non–defibrillation rhythms (asystole and pulseless electrical activity (PEA); methods of restoring airway patency, airway patency). The presence of independent breathing and the level of consciousness on the GLASGOW coma scale at the time of the patient`s hospitalization.

A total of 384 cases of successful cardiopulmonary resuscitation at the pre–hospital stage were analyzed. The criteria for inclusion in the group were CPR at the pre–hospital setting and hospitalization of the patient in a hospital with restored heart rhythm. The whole array of patients and analysis of the above indicators performed in subgroups of patients depending on the first rhythm of sudden cardiac arrest: with defibrillation and non–defibrillation rhythms. Selected indicators and their research were conducted according to the Utstein principle.

Data Processing. Some indicators are calculated as averages in the form of M±m, where M – the arithmetic mean, m – the standard error of the mean.

Results of the study and their discussion. During 2017–2019, at the prehospital stage in Ukraine, 25.383 CPR attempts were made in patients with a sudden cardiac arrest, by ambulances. Of these, only 2285 cases were successful, and patients were hospitalized with signs of life and restored heart rate. As it can be seen from table 1, the number of CPR attempts has been increasing for three years, although the number of successful attempts remains at the same level.

Table 1

Total number of successful cardiopulmonary resuscitations at the prehospital stage in Ukraine

	Years		
	2017	2018	2019
The number of CPR at the prehospital stage	7878	8366	9205
Number of successful CPR at the prehospital stage	750	767	768
% of successful CPR at the prehospital stage	9.6	9.2	8.3

The following results were obtained in the subgroup of the study where defibrillation rhythms were recorded in 185 cases (48.2%). Most of the cases observed in men –138 (74.6%), women were 47 (25.4%). The first recorded rhythm of circulatory arrest: ventricular fibrillation (VF) – 169 (91.4%) cases; pulses ventricular tachycardia (pVT) – 16 (8.6%) cases. In the subgroup, in 22 (11.9%) cases, assistance was provided by paramedic EMS teams, 163 (88.1%) – medical (doctors) EMS teams. The mean age of patients was 57.5 ± 1.1 years: in men, mean age was 56.0 ± 1.2 years, in women mean age was 62.3 ± 2.5 years. In the age group up to 10 years was recorded 1 case (0.5%), from 11 to 20 years – 5 cases (2.7%), from 21 to 30 years – 5 cases (2.7%), from 31 to 40 years – 10 cases (5.4%), from 41 to 50 years – 21 cases (11.4%), from 51 to 60 years – 61 cases (32.9%), from 61 to 70 years – 54 cases (29.2%), more than 71 years – 28 cases (15.1%).

Causes of circulatory arrest in the subgroup with defibrillation rhythms: acute coronary syndrome – 144 (77.8%) cases; unknown – 11 (5.9%) cases; other – 7 (3.8%) cases; intoxication – 6 (3.2%) cases; acute heart failure – 5 (2.7%) cases; stroke – 4 (2.2%) cases; trauma – 3 (1.6%) cases; pulmonary embolism – 3 (1.6%) cases; upper airway obstruction – 1 (0.5%) cases; electric trauma – 1 (0.5%) cases.

Place of incident in the subgroup with defibrillation rhythms: at home – 112 (60.5%) cases; in ambulance – 27 (14.6%) cases; street – 26 (14.1%) cases; work place – 13 (7.0%) cases; in hospital – 7 (3.8%) cases.

First medical group in this subgroup provided before arrival medical team in 22 (11.9%) cases, of which used AED only in 1 case.

Overall time of resuscitation in the subgroup with defibrillation rhythms was 19.4 ± 1.2 min (in men – 19.4 ± 1.3 min., in women – 18.3 ± 2.5 min.): from 1 to 10 minutes – 74 (40%) cases, from 11 to 20 minutes – 45 (24.3%) cases, from 21 to 30 minutes – 25 (13.5%) cases, more than 31 minutes – 41 (22.2%) cases.

In the subgroup with defibrillation rhythms airway patency provided by: tracheal intubation – 35 (18.9%) cases; bag–valve mask – 34 (18.4%) cases; and laryngeal mask airway – 116 (62.7%) cases. Thus, in most cases, airway patency provided by laryngeal mask. This is justified during CPR at the prehospital stage. The number of patients after CPR with spontaneous breathing during hospitalization were 168 (90.8%) cases and without spontaneous breathing – 17 (9.2%) cases. The level of consciousness according to GLASGO coma scale was average 10.0 ± 0.3 points: 15 –14 points – 61 (32.9%) cases, 13–12 points – 20 (10.8%) cases, 11 – 9 points – 15 (9.7%) points, 8–3 points – 86 (46.5%) case.

There were 199 cases (51.8%) in the subgroup of patients with non–defibrillation rhythms. As in the subgroup with defibrillation rhythms most of the cases observed in men –118 (59.3%), women were 81 (40.7%). The first recorded rhythm of circulatory arrest in this subgroup was asystole – 157 (78.9%) cases and pulses electrical activity (PEA) – 42 (21.1%) cases. In this subgroup, in 40 (20.1%) cases, assistance was provided by paramedic EMS teams, and 159 (79.9%) cases provided by medical (doctors) EMS teams. The mean age of patients was 56.1 ± 1.5 years: in men, mean age was 53.4 ± 1.9 years, in women mean age was 60.0 ± 2.3 years. In the age group up to 10 years were 9 cases (4.5%), from 11 to 20 years – 7 (3.5%) cases, from 21 to 30 years – 5 (2.5%) cases, from 31 to 40 years – 18 (9.0%) cases, from 41 to 50 years – 25 (12.6%) cases, from 51 to 60 years – 43 (21.6%) cases, from 61 to 70 years – 38 (19.1%) cases, more than 71 years – 54 (27.1%) cases.

Causes of circulatory arrest in the subgroup with non-defibrillation rhythms: acute coronary syndrome – 47 (23.6%) cases; stroke – 28 (14.1%) cases; intoxication – 21 (10.6%) cases; unknown – 14 (7.0%) cases; pulmonary edema – 13 (6.5%) cases; other – 13 (6.5%) cases; asphyxia – 12 (6.0%) cases; pulmonary embolism – 11 (5.5%) cases; hypovolemic shock – 9 (4.5%) cases; diabetes mellitus (metabolic disorders) – 8 (4.0%) cases; bronchial asthma – 7 (3.5%) cases; trauma – 6 (3.0%) cases; drowning – 3 (1.5%) cases; anaphylactic shock – 3 (1.5%) cases; electricity – 2 (1.0%) cases; hypothermia – 2 (1.0%) cases.

Place of incident in the subgroup with non-defibrillation rhythms: at home – 121 (60.8%) cases; in ambulance – 33 (16.6%) cases; at street – 28 (14.1%) cases; at work – 3 (1.5%) cases; hospital – 14 (7.0%) cases.

First medical group in this subgroup provided before arrival medical team in 30 (15.1%) cases, all without AED.

Overall time of resuscitation in the subgroup with non-defibrillation rhythms was 21.1 ± 1.1 min (in men – 21.1 ± 1.4 min., in women – 21.0 ± 1.8 min.): from 1 to 10 minutes – 64 (32.2%) cases, from 11 to 20 minutes – 45 (22.6%) cases, from 21 to 30 minutes – 32 (16.1%) cases, more than 31 minutes – 58 (29.1%) cases.

In the subgroup with non-defibrillation rhythms airway patency provided by: tracheal intubation – 68 (34.2%) cases; bag–valve mask – 28 (14.1%) cases; and laryngeal mask airway – 103 (51.7%) cases. As with defibrillation rhythms, in most cases non-defibrillation rhythms, airway patency provided by laryngeal mask.The number of patients after CPR with spontaneous breathing during hospitalization were – 144 (72.4%) cases and without spontaneous breathing – 55 (27.6%) cases. The level of consciousness according to

GLASGOW coma scale was average – 7.6 ± 0.3 points: 15 –14 points – 32 (16.1%) cases, 13 –12 points – 12 (6.0%) cases, 11 – 9 points – 17 (8.5%) cases and 8–3 points – 138 (69.3%) cases.

Analyzing the obtained results, we can conclude that the level of successful CPR in case of sudden cardiac arrest at the prehospital stage in Ukraine is much lower in comparison with the countries where the developed EMD system functions. It should also be noted that medical EMS teams perform most CPR in pre-hospital stage in Ukraine. Unlike in EU countries where most teams are pre-hospital are paramedics. Thus, in the EU the number of successful CPR is up to 40% [4]. The indicator of providing medical care before the arrival of the EMD team, which according to our data is 13.5% in the general group, is noteworthy. The AED was used only in one case. This can be explained by the fact that in Ukraine there is no system of affordable defibrillation at the prehospital stage. In our opinion, the absence of this element in Ukraine will significantly limit the number of successful CPR in prehospital stage. It is well known that this is an important factor in increasing the number of successful resuscitations at the prehospital stage [1, 7]. Also, attention should be paid to the mean age of patients, who averaged 55.5±3.6 years. Analyzing the data of other researchers, the average age of patients with sudden cardiac arrest in the EU and the US is more than 65 years [2, 11]. Such data in the studies can be explained by the fact that cases of CPR in large cities were taken into account. There is also a difference in the number of defibrillation and non-defibrillation rhythms. In our study, there was an equal number of both defibrillation and non-defibrillation rhythms. However, as shown in other studies at the prehospital stage, most rhythms of sudden cardiac arrest are not defibrillation rhythms [10]. In our opinion, this difference is explained by the fact that most cases of sudden cardiac arrest, according to our data, occur in the presence of EMD teams. It should be noted that we have not analyzed all cases of successful CPR at the prehospital stage, as in Ukraine there is no system for collecting information about such cases. In fact, cases of CPR in large cities were analyzed which is an element of limitation of our study. For better understanding the result of treatment of patients with sudden cardiac arrest, it is necessary to continue the analysis and study the features of treatment of such patients at the hospital stage.

Conclusion

1. The percentage of successful CPR in Ukraine in 2019 was 8.3%, which is significantly lower than in countries with developed emergency medical system.

2. The main cause of sudden cardiac arrest at a pre hospital stage in case of non-defibrillation and defibrillation rhythms are acute coronary syndrome, respectively – 23.6 % and 77.8%.

3. The number of successful cases of cardiopulmonary resuscitation is an important indicator of the effective functioning of the EMD system.

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