Investigating Outcomes of Performing Cardio - Pulmonary Resuscitation in Emergency Medical Services (EMS) Occasions from April 2008 to March 2009

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Abstract: One of the most stressful Emergency Medical Services (EMS) missions is facing with patients or injured people who are afflicted with pulmonary or cardiac arrest and if they don't receive appropriate cardio pulmonary resuscitation (CPR), these patients within a few minutes from the brain dead, enter to a stage which is called clinical death. Statistics show that of all people who suffer from cardiac arrest outside of the hospital, only 25% of them go under cardio pulmonary resuscitation and naturally those areas, which have strong emergency systems had reported a significantly higher survival rate in comparison with other regions. Hence by taking the importance of this issue into account, a research aiming to determine the ultimate success of CPR during Emergency Medical Services in Bandar abbas was done.**Materials and Methods:** In this retrospective study 96 patients who were gone under CPR by Emergency services in Bandar abass from April 2008 to December 2009 were studied. Data including age, sex, hospital arrival time, the first rhythm checked by the medical emergency personnel, tubing, the need to recover different types of trauma, and the final state of CPR recovered which in all cases were extracted based on pre-hospital care report(115 emergency) form.**Results:** 78.1% of the subjects were male and the rest were females. The average age of these people was 44.97±23/6. Of all cases who went under CPR about 80.2% of cases were inner-city missions and the rest were suburban emergency missions. In this study the main complaints of the patients who experienced CPR include 10.4% dyspnea, 10.4% decrease in the level of consciousness, 51% respiratory cardiac arrest, 15.6% Accident, 4.1% drug intoxication, 2.1% Falling from a height, 3.1%, electric shock, and 1 % includes fall, was a stab and bite. 21.9% of patients were under cardiac monitoring or ECG and for 13.5% of patients electric shock was applied. **Discussion:** In this study, of all the total CPR patients about 13.3% of these patients with spontaneous return of vital signs, and 29.2 % Without return of vital signs were delivered to hospitals in Bandar Abbas and 39.6% of patients had died on the way before reaching the hospital. of all those people who were sent to hospital with the vital signs 5.2% were discharged from hospital with the minimal injury and brain injury. There weren't significant relationships between a successful CPR during EMS conditions and variables such as age, use of electric shocks, ambulance arrival time to the patient, the qualification and degrees of personnel and quality of cardiac monitoring ($0.05 \leq p$). A significant relationship was found between successful resuscitation during EMS and the main complaints ($P \leq 0/05$). **Conclusions**: In this study, in general it can be concluded that patients who experienced CPR had poor prognosis. Hence it is appropriate to focus on raising knowledge and skills regarding cardiopulmonary resuscitation through various programs and we notice an increase in the rate success in the performed cardiopulmonary resuscitation.

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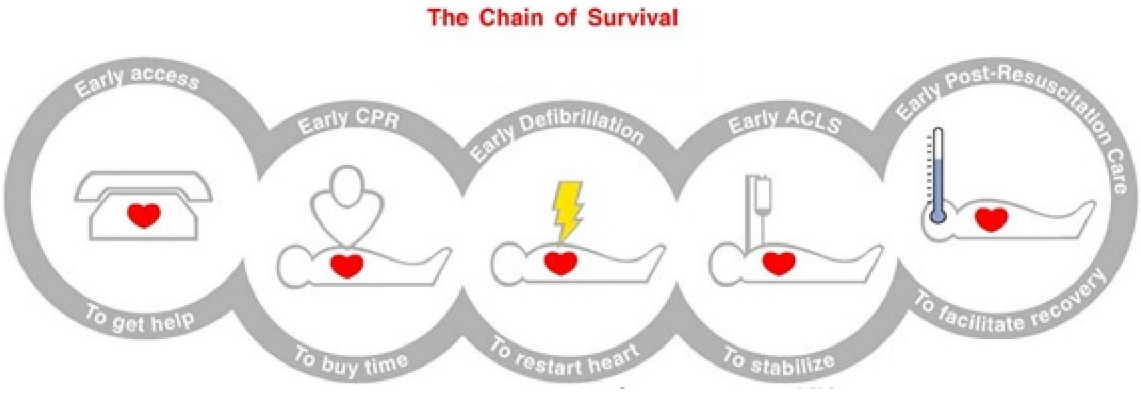
Introduction:

Emergency Medical Service is an important part of the system which provides medical services. These Systems play a key role in offering EMS and transferring of patients to medical centers. The aim of such medical services is to provide appropriate treatment, at proper time and location by using available resources. Emergency Medical Services includes all those services which begins from bedside patients and ends at Emergency Center in the hospital. Some studies includes these services until the patients discharge from hospital. Major groups of patients who need EMS include patients who have internal disease without trauma and traumatic patients at the scene of accident(1). One of the most stressful emergency missions is to deal with patients or victims who have suffered from cardiopulmonary arrest(2). Cardio-pulmonary arrest is one medical cases which can occur unexpectedly at any time or any place and half of the deaths occurs as the result of it. Studies have shown that in the United States about 350000 – 400000 people die each year

due to sudden cardiac death. The majority of these deaths are due to coronary artery atherosclerosis that occurs outside of the hospital(3, 4). A patient, who suffers from cardiac arrest, is unconscious, not breathing and you can not feel the pulse of the patient, and the patient seems dead. Early treatment without considering cause of cardiac arrest is the same in all cases of cardiac arrest: CPR (5).

Cardio-pulmonary Resuscitation (CPR) refers to operations in which blood flow and entry and exit of air into the lungs and out of them is done artificially in a patient who is not breathing and doesn't have pulses(5). Cardio-pulmonary resuscitation is the process by which it is tried to rehabilitate three vital organs of the body (brain, heart and lungs) and make it possible for the patient to survive(6). Although in many cases lives of patients could be saved by pacing CPR operations, however, rates survival and improvement of long-term outcomes of patients after resuscitation is related to rapid onset of resuscitation and performing advanced cardiac interventions; and this is in fact dependence on the very sequenced stages of chain of survival (Fig. 1) including the identification and immediate access to the patient, pacing CPR operation and basic life support, early defibrillations of the patients and advanced life support to the patient(7, 8).



The total percentage of those who suffer from cardiac arrest outside of the hospital, only 25% of them are under pulmonary, cardiac, pulmonary and cerebral resuscitation *(CPCR)(4)*. Naturally those places which had a strong emergency medical system (EMS) has reported significantly more survival rates compared with other regions, whereas of the camel, in addition some urban areas have reported survival and hospital discharge as about 30%, whereas in rural areas of this reaches less than 10%(7, 9). The results of studies in our country have reported that survival rate varies between 0.2% to 31%(3, 7, 10, 11).

Results of a study which was done by Nicole[1] et al in 10 states of North America (8 states of the United States and 2 states Canada) from 2006 to 2007 has showed that only 4.6 % of these patients survived ad were discharged from hospital(12).

Results of Lori`s study on investigating 24 EMS systems in Ontario, Canada in patients who were over 18 years old and suffered a cardiac arrest and emergency medical technicians ((EMT) tried to treat them by using automated external defibrillator (AED) and standard guideline has reported survival rate just as 0.5%(13)

Kamila et al. by examining 5505 patients with heart failure and were under the basic life support BLS and advanced life supports ALS has showed that of 47.1% of patients who had received CPR and BLS services outside the hospital received only 0.2% (n = 5) of the patients were discharged from the hospital. No rehabilitation outcomes in 1192 patients (21.7%) who received ALS services have been found(14)

Salari et al. in a study on investigating survival rate after cardiac arrest which occurred outside of the hospital in Tehran showed that 73 percent of CPR were unsuccessful and resulted in the death of patients and 27% of patients have returned blood flow and heart rate until they have reach to Emergency unit of the hospital. But of all these only 4 percent had the long-term survival and were discharged from the hospital(15).

Table 1: Mean of cardiopulmonary resuscitation in the studies reviewed

Outcome of cardiopulmonary resuscitation	Initial resuscitation	
9.37%	34.18%	mean of some studies within one country
10.2%	34.4%	mean of several studies in other countries

investigating different studies carried out in the our country has showed mean of the early success of the CPR as 34.18% and overseas studies this rate has been reported as 34.4% and final success rate and on the inside and outside studies were also 9.37% and 10.2% respectively. Therefore the current study was conducted aiming to determine the success rate of cardiopulmonary resuscitations (CPR) in Emergency Unit before entering the hospital.

Methods:

This study was a retrospective descriptive case series reports. A check list was designed in order to extract the required data. This check list includes the patient`s age and sex, the reason for needing CPR, history of chronic disease, the general condition of patients, the result of CPR and etc.

By using this check list, emergency mission forms of all those patients who were resuscitated by EMS either in the ambulance or accident scene during April 2008 to March 2009 were reviewed. All those patients or victims who were resuscitated at accident scene or in the ambulance were included as the participants of this study.

The subjects of this study include all those patients and victims who asked emergency assistance in Bandar Abbas and EMS helped them and based on emergency technicians` diagnosis the CPR operations have been performed on them.

Those patients who were afflicted with cardiac - pulmonary arrest before arrival of emergency and were suffered from physiological death and went under no resuscitation operations were exclude from this study. Such cases were considered as codes from 10 to 35 in emergency services and since no action they were omitted from the sample.

The context of current study includes the mission areas of urban and road sites around the city of Bandar Abbas, which totally has three urban bases and four road bases.

For data analysis statistical software SPSS 19 was used. Descriptive statistical tests include median, mean, standard deviation, and frequency. The final results of resuscitation were considered as unsuccessful resuscitation (patient`s death), primary survival (short term outcome) which means the spontaneous return of blood flow when the patients is delivered to hospital.

Results

78.1 Percent or (75 people) of those who received CPR operations were male and the rest were female. Overall mean age of the samples with the range of 1 to 91 years old was 44.97± 23.6. The initial success rate was not significantly different in the two sexes. 80.2 percent of the missions which require resuscitation operations were within the urban area and the rest were in suburban area.

About 13.3% of the employees had less than 5 years work experience. 55.6% of them had been working as emergency personnel between 5 to 15 years, and about 11.1% of them had worked more than 25 years in emergency services. The average of work experience in combining operating teams was 4.88 years. 53.1 percent of CPR were operated in residential context, 30.2 percent at work and 2.1% of the CPR were in sports and entertainment places. 45.8% of cases on were CPR by emergency technicians from 2:00 p.m to 8:00 p.m and 34.4% of were resuscitated from 8:00 p.m to 8:00 a.m. Time of ambulance arrival bedside of the patients who needed CPR operations in 68.8% of cases was less than 7 minutes, and in 3.1% of the cases the victims were transferred to the medical base. The mean time to reach bedside the patients was 6.67 minutes.

39.6% of Emergency Medical Technicians who had done CPR had a secondary school degree and 36.5% of ambulances had personnel with either secondary school degree or BS in nursing.

The findings of this research show that 51% of cases who received CPR services were admitted with the main complaint, the cardio-pulmonary arrest, and also 15.6% had traffic accidents and 10.4% of the main complaints were of asthma and loss of consciousness.

Table 2: results of the analysis of check list

Results ← / ↓ Variable		Unsuccessful resuscitation at the scene	Delivery of patient without vital signs	Successful initial resuscitation	Hospital discharge	Died in hospital
Age	Less than 13 years	2	0	4	1	3
	Between 14 to 25 years	2	3	4	1	3
	26 to 40 years	7	10	6	2	4
	41 to 55 years	6	10	7	0	7
	56 to 70 years	9	1	6	0	6
	71 years	11	4	3	1	2
Gender	Man	30	23	22	4	18
	Woman	8	5	8	1	7
Type of Mission	Within the city	29	22	26	4	22
	Suburban	9	6	4	1	3
Shift	8 to 14	6	4	9	1	8
	Hours: 14 to 20	19	14	11	1	10
	20 pm to 8 am	13	10	20	3	17
location of cardiac pulmonary arrest	Residential	22	13	16	2	14
	Educational	0	1	4	1	3
	Work	10	11	8	2	6
	Sports and Recreation	0	2	2	0	2
	Nature	6	1	0	0	0
The main complaint	Asthma	3	23	4	1	3
	Loss of consciousness	2	1	6	0	6
	Cardiopulmonary arrest	23	11	11	1	10
	Traffic Accidents	7	2	5	2	3
	Toxicity	0	1	1	1	0
	Bite	0	0	2	0	2
	Fall	1	0	1	0	1
	Electric shock	1	0	0	0	0
	Knife corrosion	1	0	0	0	0
checking cardiac rhythm	Yes	5	9	7	1	6
	No	32	19	23	4	19
use of electric shock	Yes	4	5	7	4	3
	No	33	23	23	1	22

The analysis of check list showed that for 82% of patients finding vessels was operated and 49% of patients were suctioned. For 21 patients (21.9%) of patients who had received CPR cardiac monitoring was done and 13.5% of these patients underwent defibrillator and in 85.4% no cases of electric shock

was recorded and also for 71.9% of patients' intubation was performed.

The results showed that 31.3% of the patients who had CPR with vital signs were taken to hospital and 68.7% of the patients without any vital signs were delivered (Table 3).

Table 3 - Distribution of the mission

Results of CPR procedure	Frequency	Percentage
Delivery of patient with vital signs (primary measure of initial success in pre-hospital emergency resuscitation)	30	31.3
Delivery of patient without vital signs	28	29.2
Death of patient on the way or before arriving to the hospital	38	39.6

No significant correlation was found between the results of CPR and variables such as: type of mission, month and context of missions, mission time, the emergency medical technicians` degrees, and their sex. Though there were no significant negative correlation between the result of CPR and variables such as time of the ambulance arrival bedside the patient at the level of significance 0.05, in other words results of CPR had inversely related to time of ambulance arrival so that the longer the ambulance arrival the more unsuccessful was the CPR operations. Furthermore there was a reverse relationship between the results of CPR and kilometers traveled and age of patients. It means that the more kilometers were traveled the less successful are the results of CPR.

Also what can be deduced from the analysis is that the outcome of cardio-pulmonary cerebral resuscitation and average work experience of emergency personnel are positively related. The outcome of cardiopulmonary cerebral resuscitation and results of cardiopulmonary resuscitation of the emergency personnel are positively related.

No significant relationship was found between the average work experience of emergency medical technicians, and survival of patients.

Discussion:

The results show that the survival rate after cardio-pulmonary resuscitation in EMS in Bandar Abbas is close to the national average. The final success rate of CPR was also 5.2% and this is less than the average rate in several studies (Table 1). Although this rate was higher than Salari`s research(15, 16).

In other words of 96 patients who were transferred to hospitals of Bandar Abass by EMS of this city 5 patients were discharged from hospital with minimal brain injury.

Table 4: Consequences of cerebral cardiopulmonary resuscitation

	Frequency	The relative frequency
Hospital discharge with minimal brain lesions (a measure of the final success of resuscitation)	5	5.2%
Died before or after hospital arrival	91	94.8%

The results of the current study also showed that the survival rate after cardio-pulmonary resuscitation in non-traumatic patients was more than the national rate and in traumatic patients this rate was lower than the national average.

The survival rate in this study is defined as the total number of known survivors to total population which has been equal to 0.052%. These rates for traumatic patients and in non-traumatic patients were respectively 0.125 and 0.0375. These findings suggest that of 16 traumatic patients who had received CPR operation only 2 of them were discharged from the hospital alive. The results of this study showed that this rate is less than 0.0375 which is the survive rate in non-traumatic patients.

But in general we can say that patients who received CPR especially in cases with cardiac arrest caused by trauma, had poor prognosis, which is consistent with the research done in this regard(17).

This research has shown that the use of appropriate medical teams with combination of education and experience in raising the survival rate is effective.

Investigating the correlation between CPR which was done by emergency medical technicians and by the final outcome of the qualification and experience of Emergency Medical Technicians in this project showed that the no significant relationship was found between the combination of education, experience and the final outcome of CPR. In other words the hypothesis of more success of medical teams with higher academic degrees won`t be approved. And the results of the current study are consistent with the results of a study that showed that the attendance of the physician has no effects in the results of the CPR operations(14).

This study demonstrated that use of electric shock, on survival of non-traumatic patients who received cardio-pulmonary resuscitation is effective.

By investigating statistical test which measures the correlation of the cardiopulmonary cerebral resuscitations by emergency personnel (and α=0.05 level of significance) it was found that there is a direct connection between the use of electric shock and cardio-pulmonary cerebral resuscitation however this relationship is not meaningful.

The results of this study is consistent with the results of other studies in which sex distribution, location of cardiac arrest, type of supportive actions, initial rhythm checked in emergency, and intubation in patients did not significantly correlated with the patients` final state(15-18), but the results of the current study is inconsistent with other studies and this could be due to less use of electroshock in this study and the lack of this machine in most of ambulances during the period of the current investigation.

By considering the main issue of this study, in all available resources, the survival rates in studies done in other countries, was mostly more than 3%. These statistics indicate that the effectiveness of cardiac pulmonary resuscitation process in the centers which were studied during research years was less than its equivalent rate in other countries (19). Another conclusion that can be made from these results is that the effectiveness of CPR process differs from one city to other or from one hospital to another and from emergency 115 to other centers.

Different factors could be effective in this regard, factors such as lack of adequate space in hospitals, lack of adequate medical staff in emergency departments of hospitals, insufficient coordination between the units and absence of standard EMS centers and mobile units.

Given that over the past fifty years, great advances in techniques, medications used to treat, and skills of medical personnel has been created, but the mortality rate of deaths after cardiac arrest is still very high in comparison with other factors. The previous studies have mentioned various factors that could affect the quality of cardiopulmonary bypass operations at the clinic one of which is training the emergency personnel(20)studies have shown that in hospitals that have trained, skillful, and qualified teams the success rate of CPR and hospital discharge increases (21) researchers believe that in order to establish the chain of life in a hospital, skilled and qualified medical staff, the necessary equipment, having efficient and effective lines of communication and organization, and effective leadership is needed. Defect in any of the aforementioned factors, will impact on the results of CPR process (22)

The results of a study which was done by Karimnejad et al showed that by applying experienced and stable personnel in the emergency unit will dramatically improve CPR outcomes. Thus, the resultant of resuscitation process was nearly doubled after performing CPR, and the average of recovery time was almost four times(23). Although effective factors on the success of CPR were not investigated at the level of pre-hospital emergency, there is no doubt that cardiopulmonary resuscitation operations will change by activating the forth loop which is combination of skills and appropriate use of medical equipments. By considering academic degree of those people who participated in CPR operations it was found having academic degree as well as high qualifications and practical skills by emergency technicians affects the results of CPR. Although the statistical analysis of the data has showed direct but non-significant relationship between this two categories(24). But the results of this study is not consistent with the results of a study in which a direct and significant correlation was found between the working experience of the supervisor who is present during CPR and CPR operations (p=0.04)(24).

Hence, given that the knowledge and skills learned in the realm of CPR decreases by passing time it is desirable to maintain the required knowledge and skills be retrained and repeat in this area. Which this trend can increase survival rates after operating appropriate CPR.

The results of this study showed that 31.3 percent of people who had received cardio-pulmonary resuscitation were delivered to hospital with spontaneous return of circulation but survival rate or ultimate success was 5.2% and although this results is close to results of researches in Iran but a number of factors play role in creating these results. Some of these factors relate to hospital care, the results of a descriptive study of 128 personnel in emergency unit, who had direct involvement in performing CPR

process, according to the medical emergency have showed that, the most important cause of inefficiency of CPR is due to hospital personnel so that 81% of inefficiency of CPR is due to lack of a sufficient number of experts in the CPR team and 66% of inefficiency of CPR is due to inconsistency of personnel in being on time. Regarding other inefficient factors related to inefficiency of CPR, 59% of cases has reported violence of the patients` relatives as an impending factor and the least inefficient factor in this regard was within the physical space and facilities for CPR (36%)(25). Now by taking the results of this study into account it is suggested that effective factors in reducing the success rate of CPR process in-hospitals of Bandar Abass be evaluated. Furthermore in these cases the permanent presence of an expert doctor in Emergency Medicine without limit will be effective in the success of CPR.

Researchers have the following suggestions to implement more desirable researches in the area of evaluating outcomes of cardio pulmonary cerebral resuscitations:

– Due to importance of comparing the performance of the survival chain, the success rate of cardiopulmonary cerebral resuscitation in the different departments of hospital especially the emergency units of hospitals in Bandar Abbas is assessed and its success rate is compared with the success rate of cardiopulmonary cerebral resuscitation in pre hospital conditions.

- Due to variety of intervening factors in the success of cardiopulmonary resuscitation these factors are recognized in both pre-hospital and hospital situations.

– Due to various combinations of personnel with various educational degrees in EMS teams it is suggested that the emergency personnel`s knowledge and awareness of CPR is examined.

The researchers have also proposed some suggestions for the relevant organizations and stakeholders:

- Center of EMS and Disaster Management as trustee of pre-hospital emergency medical services with respect to the impact of job experience and education use personnel with academic degree in the emergency ambulances.

- Due to investigating records of emergency operation forms and examining pre-hospital care reports and incompleteness of these reports it is necessary that actions be taken in training the report writing.

- More attention should be paid to the chain of survival, different causes of success and failure of cardiac resuscitation and predictors of success in cardio pulmonary resuscitation should be addressed.

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