Inhospital Factors Affecting Survival Rate of Out of Hospital Cardiac Arrest Patients in Emergency Department At Malang: A Case Study At Emergency Department At Malang

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Abstract: *Mortality rate due to by out of hospital cardiac arrest is still common and it becomes public concern. There are five chains emergency set by AHA that should be applied in every emergency situation. PAROS (Pan Asian Resuscitation Outcome Study) of outside hospital service system is expected to be able to give comprehensive description on service system and its gap in order to improve the quality of system of pre hospital service. therefore, mortality rate caused by cardiac arrest might be reduced. This research aims to find out inhospital factors affecting survival time of out hospital cardiac arrest. It is analytical observational research with cross sectional approach and uses retrospective data to find out the effect of inhospital factors on survival time. The number of sample is 32 patients with inclusion and exclusion criteria. This study is conducted at Emergency Department of Hospitals in Malang during January 2016 to January 2017. Most patients with sudden cardiac arrest are male with ratio 68,7:31,3 with the age ranging from 61-70 years old. There is a meaningful correlation between initial cardiac rhythm, administration of resuscitation drugs, defibrillation and using advance airway device to categorical survival time (p<0.05), and for ROSC, there is no such thing as meaningfull correlation to categorical survival time (p>0,05). However, there is a tendency that for patients with ROSC, their categorical survival time is up to ≥ 8 hours, and there is no such thing for patients without ROSC. The research concludes that factor influencing survival time of out of hospital cardiac arrest patients is initial cardiac rhythm.*
Keywords: sudden cardiac arrest, out of hospital cardiac arrest, initial cardiac rhythm, survival time

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I. Introduction

Out of hospital cardiac arrest (OHCA) is latest issue and becomes public concern (Nichol et al., 2008). Cardiac arrest is a condition in which blood circulation stops due to failure of heart to function effectively. Clinically, cardiac arrest is marked by loss of pulse and breath (Hollenberg., et al 2008). Cardiac arrest might occur to person diagnosed to have heart disease or not. Therefore, hypoxia or lack of oxygen cell in vital organ such as brain, lung, heart and kidney occurs (Jameson., et al, 2005; Travers., et al 2010). It might occur in or out hospital. Up to know, it still becomes a big challenge for health practitioners although there has been enormous advancement in hospital management and standardization of advanced life support through AHA guidance. Global data of 2015 shows that more or less there has been 600.000 sudden cardiac arrest in hospital and 395.000 cases of out of hospital cardiac arrest (Graham et al., 2015). Each year, in America there are 300.000 people with out of hospital cardiac arrest (Mitrani et al., 2016). While in Indonesia there is no definitive data on survival rates in cases of cardiac arrest. However, this study on out of hospital cardiac arrest is conducted in Malang.

There are many causes of cardiac arrest and by knowing them well will help us to handle the patients during resuscitation and return of spontaneous circulation. In general, the cause of cardiac arrest are cardiac, lung, circulation disruption, toxic, metabolic disorder and accident. On cardiac arrest, global and sudden multi organ ischemia occurs. On that occasion, cells in the body activate stress response by increasing the release of various inflammation mediators (such as IL-6, IL-8, IL-10, TNF-α) by activating complement and polymorphonuclear leucocyt (PMN). On that cellular level, integrity and function of mitochondria are damaged, it triggeres the release of important enzymes such as cytochrome-C and disruption of oxidative phosporilation. The damage on mitochondria is marked by increasing concentration of free radicals oxygen and the activation of dead cell program. For cardiac and lung resuscitation to be successful, there must be integrated and continuous measure known as survival chain (Paradis et al., 2007; Tintinalli et al., 2016). Based on AHA guidance (2010), it is hard for health practitioners to find out factors influencing survival time on returning to spontaneous

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circulation for patients with out of hospital cardiac arrest due to lack of research study showing data of cardiac arrest cases. Therefore, researchers would like to study inhospital factors affecting survival time of out of hospital cardiac arrest patients in Emergency Department in Malang.

A. Research Method

It is analytical observational study with cross sectional approach and it uses retrospective data to review inhospital factors affecting survival time of out of hospital cardiac arrest patients in Emergency Department in Malang (initial cardiac rhythm, CPR, defibrillation, using advance airway device, resuscitation drugs). The sample obtained in this study are 32 patients with out of hospital cardiac arrest at Emergency Department in Malang. Samples are selected using inclusion criteria that is all out of hospital cardiac arrest patents in Emergency Department in Malang which age over 18 years old and not a trauma patient. The data are taken from January 2016 – January 2017. This study employs OHCA PAROS questionnaire. Primary data are filled by health practitioners involving in resuscitation process of patients. There is also other data filled by researcher and nurse in triage as enumerator. To obey research ethics, data are taken after doctors responsible for the patients declares that resuscitation process is completed.

B. Findings and Analysis of Research Data

The analysis result of data on cardiac arrest patients meeting the predetermined criteria of inclusion and exclusion in order to find out inhospital factors affecting survival time of cardiac arrest patients outside hospital in Emergency Department in Malang. The data are taken for one year during January 2016 up to January 2017 in Emergency Department in Malang.

Table 1. General characteristics of out hospital cardiac arrest in Emergency Department in Malang

No.	Characteristics of Sample		Number	Percentage (%)	Mean ± SD	Med (min-max)
1.	Sex	Male	22	68,7		
		Female	10	31,3		
2.	Age				60 ± 14 year	61 (21-85)
		21 – 30 years old	2	6,2		
		31 – 40 years old	1	3,1		
		41 – 50 years old	2	6,2		
		51 – 60 years old	10	31,2		
		61 – 70 years old	11	34,3		
		71 – 80 years old	5	15,6		
		81 – 90 years old	1	3,1		
3.	History of previous disease	No history of disease	6	18,7		
		1 history of disease	14	43,7		
		2 history of disease	9	28,1		
		3 history of disease	3	9,3		
4.	Types of History Previous disease	No history	10	31,2		
		Cardiac	8	25,0		
		Hypertension	4	12,5		
		Diabetes mellitus	7	21,9		
		Lung	1	3,1		
		Cancer	1	3,1		
		Others	1	3,1		
5.	Type Transportation used	EMS ambulance	0	00,0		
		Non EMS ambulance	2	6,3		
		No ambulance	30	93,8		

6.	Location of	Home	21	65,6
	Cardiac arrest	ambulance	8	25,0
		private cars	3	12,0
7.	Duration of	- 0-5 minutes	9	28,1
	cardiac arrest	- 6-10 minutes	9	28,1
		- 11-15 minutes	10	31,2
		- 16-20 minutes	1	3,1
		- > 20 minutes	3	9,3
8..	Causes of	Cardiac	24	75,0
	Cardiac arrest	Respiratory	5	15,6
		Others	3	9,3

Distribution of male patients compared to female is 22 people (68.7%) and 10 people (31.3%). Based on age distribution, it is found out that the highest number of patients with out of hospital cardiac arrest in Malang are at the age of 61-70 years old or 34.3%, the second highest is those of 51-60 years or 31.2% and the third highest is those of 71-80 years old or 15.6%. Several out of hospital patients with cardiac arrest have comorbid or previous diseases history. It is observed from the finding shown that 8 patients (25%) has previous disease, 9 patients (28.1%) has 2 previous disease and 3 patients (9.3%) has 3 previous diseases. However, there are 10 patients (31.2%) with out of hospital cardiac arrest whose previous disease history are not known. From previous disease history that we obtained, it is found out that there are 8 patients (25%) having cardiac disease either coronary cardiac or cardiac enlargement, 7 patients (21.9%) with previous diabetes mellitus and 4 patients (12,5%) with hypertension. There are 10 patients (31.2%) with out of hospital cardiac arrest whose previous disease history are unknown. The others are patients with out of hospital cardiac arrest caused by lung disease, cancer, hyperthyroid, and combination of disease such as hypertension, renal failure with diabetes, suspected pulmonary embolism, disturbance of cardiac rhythm and stroke etc. Higher percentage which is 31.2% or 10 patients are patients passing away whose previous disease are unknown.

The highest number of cardiac arrest occurs at home which is 21 cases (75%), number of cardiac arrest occured in ambulance is 8 patients (25%) and the number of cardiac arrest occured in private cars is 3 occurrences (9.3%). It is due to that people are not aware of the danger of cardiac arrest or it is too late to be taken to hospital. Concerning the selection of transportation mode used to take patients to hospital, data shows that there are 30 patients (12%) taken to hospital by private cars non ambulance and 2 patients (6.3%) taken by non EMS ambulance. From all cardiac arrest occurrences in Malang, there is no patients taken by EMS ambulance.

Concerning the cause of cardiac arrest, there are 24 patients (75%) caused by cardiac origin, 5 cardiac arrest patients (15.6%) caused by respiratory problem and 3 patients with cardiac arrest (9.3%) caused by methanol intoxication and suspected with bleeding stroke. Data shows that the cardiac factors are dominant make patients come with out of hospital cardiac arrest in Emergency Departement in Malang. In this study, most patients directly taken to hospital and suspected have cardiac arrest for 11 – 15 minutes before admitted is 10 patients (31.2%) and 9 patients suspected have cardiac arrest 0-5 minutes before admitted (28.1%) and 6-10 minutes before admitted (28.1%) is 9 patients also. In addition, there are 3 patients (9.3%) taken to Emergency Department who are suspected to have cardiac arrest for more than 20 minutes.

Table 2 Clinical Characteristics of Patients in this study

No	Variable	Occurances Hospitals in Malang		Survival Time			P value
		N	%	<8 hours	8-24 hours	>8 hours	
1.	initial cardiac rhythm						0,00*
	- Asistol	26	81,3	25	1	0	
	- PEA	4	12,5	1	3	0	
	- VT without pulse VF	2	6,3	0	0	2	
2.	CPR						* *
	- CPR is conducted	32	100	26	4	2	
	- CPR is not	0	0	26	4	2	

No	Variable						P Value
	conducted						
3.	Defibrillation						0,00*
	- Defibrillation is done	2	6,2	0	0	2	
	- Defibrillation is not done	0	93,7	26	4	0	
4.	Using advance airway device						**
	- used	32	100	26	4	2	
	- not used	0	0	0	0	0	
5.	Resuscitation medicine						0,00*
	- Epinefrin	30	93,8	26	4	2	
	- Amiodaron	2	6,3	0	0	0	
6.	Survival time						0,42
	- < 8 hours	26	81,3	20	4	2	
	- 8 – 24 hours	4	12,5				
	- > 24 hours	2	6,3				
5	Status of patients			0	0	2	0,00*
	- Passed away	30	93,8				
	- life	2	6,3				

* P value < 0,05 : meaningful

** P value can not be evaluated due to that CPR and the using advance airway device are conducted to all patients

Abbreviations: PEA (Pulseless Electrical Activity), VT (Ventricular Tachycardia), VF (Ventricular Fibrillation), CPR (Cardio Pulmonary Resuscitation)

Table 2 shows meaningful difference between initial cardiac rhythm, defibrillation, resuscitation drugs and survival time. However, concerning CPR and using advance airway device, the data can not be evaluated because all patients receive CPR and using advance airway device. 100% required measures are conducted to all cardiac arrest either with early cardiac rhythm or not.

Table 3. Central Tendency at Emergency Department in Malang

No	Variables	Hospitals in Malang Malang		P Value
		X̄±SD	Med (min-max)	
1	Age	60±14	61(21-85)	
2	Duration of cardiac arrest (minutes)	12±6,8	10(5-30)	
3	Survival time (minutes)	250±369	77(10-1441)	0,01*

*p value < 0,05 : meaningfull

The above table shows that for survival time, the Standard Deviation (SD) is higher than the mean. It shows that the data variance are quite high so for analysis we use categorical survival time. Numerical data of survival time (minutes) should be tested to find out its normal distribution and it is found out that it is not distributed normally at Emergency Department in Malang. Then transformation is conducted, still the data are not normally distributed. Duration of cardiac arrest and age will be elaborated descriptively.

II. Discussion

Based on the findings, it is found out that the out of hospital cardiac arrest patients taken to Emergency Department are mostly male compared to female with proportion of 2,2:1 (22 male: 10 female). Based on Cohort Study on risk factors of cardiac arrest, it is found out that male has 4 times higher risk than female (Wallens et all, 2014). For patients age, most of them are at the age of 61-70 years old (34.3%) and 51-60 (31.2%) with age average is 60±14 years old. Retrospective study from Paris Sudden Cardiac Expertise Center since 2011 until 2014, it is found out that there are 62.1% male got out of hospital cardiac arrest with age mean of 70,3 ± 17 years old (Karam et all, 2017).

In this study, all patients with asystole rhythm or PEA is 30 patients (93.8%) and none of them survives until 30 days or 720 hours. Patients with initial cardiac rhythm VT or VF is 2 people (6.3%). Both of them survives upto 30 days or 720 hours after getting resuscitation. It confirms study conducted by Teodorescue et al (2010) that prevalence patients coming to Emergency Department with unshockable cardiac rhythm (asystole or PEA) is higher than shockable cardiac rhythm (VT/VF) and their survival time is 17.7%. In our research result for patients with unshockable cardiac rhythm, PEA is 4 persons (12,5%) and their survival time is longer than patients with asystole as their initial cardiac rhythm. Concerning survival time of the 4 patients with PEA

rhythm, 3 persons survive up to 8-24 hours (74%). Other study conducted by Saarinen et al (2012) shows that 4.1% cardiac arrest cases with early cardiac rhythm PEA might return to spontaneous circulation.

In this study, from 26 patients with asystole (81.3%), there is only 1 patients (3,8%) who survives up to 8-24 hours. It is also observed in other study conducted in Hongkong in 2012-2013 using retrospective analysis. The study shows that characteristics of patients with asystole as initial cardiac rhythm, there are 20 survivors and those with PEA as initial cardiac rhythm, there are 26 persons survives which patients with asystole is 4181 patients (81%) and PEA is 512 patients (9,9%) or comparison between asystol rhythm and PEA is 8:1 (Fan et all, 2017). In Malang study, the comparison of patients with asystole compared to PEA is 26 patients:4 patients or 6,5:1. 100% CPR is conducted to all patients and there are 2 patients (6,2%) surviving up to 720 hours or 30 days and they have VT without pulse/VF as initial cardiac rhythm. 26 patients (81.2%) can not survive more than 8 hours. 4 patients (12.5%) survives 8-24 hours. The success of CPR is because it is able to transfer oxygen and nutrition to vital organs and those are main objective of CPR when cardiac arrest occurred. Therefore, there is required for sufficient blood circulation produced by chest compression. Early high quality CPR is crucial for maximum result. In consequence, chest compression should be main priority during CPR (Committee, 2005; Halperin et all 1986).

For patients which has VT without pulse as initial cardiac rhythm or VF, defibrillation is conducted in Emergency Department in Malang. In this study, the number of patients with shockable rhythm is 2 patients (6.25%) and this measure is conducted 100%. The two patients survives up to 720 hours or 30 days. For patients with asystole or PEA, the measure conducted is immediate CPR, nevertheless it may change the rhythm into VF or VT without pulse. In case unshockable cardiac rhythm changes into shockable cardiac rhythm, the survival possibility of patients might be increase (Goto et all, 2014). Patients with asystole or PEA which are unshockable cardiac rhythm, the survival is low which is 26 patients (81.2%) and it is less than 8 hours and 4 patients survives 8 – 24 hours. For all patients of cardiac arrest, using advance airway device done to all of them. It is given either to those with shockable or unshockable cardiac rhythm. The presentation of this measure is 100%. Patients survive up to 720 hours or 30 days is 2 persons (6.25%) and they have VT without pulse or VF as initial cardiac rhythm. Managing for the airway is effort for preventing occurrence hypoxia or hypercarbia (Robert et al, 2010).

For 32 patients with out of hospital cardiac arrest, there are 30 patients (93.8%) has unshockable rhythm so they need only epinephrine and 2 patients (6.25%) with out of hospital cardiac arrest has VT without pulse and VF as their initial cardiac rhythm, they need amiodaron other than epinephrine. The two patients getting amiodaron has survival time for more than 720 hours or 30 days. In addition, patients with cardiac arrest getting epinephine due to their asystole or PEA rhythm not need amiodaron and their number is 26 patients (81.2%) whose survival time is 8 hours and 4 patients (12.5%) survives for 8-24 hour. A study on the use of medicine for resuscitation shows that the administration of epinephrine might improve the return of spontaneous circulation and the rate of survival of out of hospital cardiac arrest patients shortly (Olasveengen et al, 2012) and using antiarrhythmic drugs aim to return to a normal rhythm (AHA,2010).

Chi square is used to test all dependent variables which are factors that make patients return to spontaneous circulation in Emergency Department in Malang. It shows that there is meaningful correlation between survival time with survival status of patients up to 720 hours or 30 days. It is found out that there are 2 patients (9,3%) who are able to return to spontaneous circulation with survival time of 30 days and patients with survival time less than 720 hours or 30 days are 30 patients (93,8%). It shows that the longer patients survive, the better their living status especially for those whose categorical survival time is >24 hours.

III. Conclusion And Suggestion

Based on the analysis of correlation between variables used in this study, there are several conclusion that might be drawn our knowledge on service processes and first support for out of hospital cardiac arrest patients. Initial cardiac rhythm of patients in Emergency Department has meaningful correlation with their survival time of 30 days or 720 hours. Therefore, by knowing this initial cardiac rhythm, medical practitioners might conduct defibrillation and administer different resuscitation drugs for patients with shockable rhythm. Cardiopulmonary Resuscitation or CPR and using advance airway device in Emergency Department must be conducted for both patients with shockable or unshockable rhythm. Defibrillation in Emergency Department must be done for patients with shockable rhythm. Resuscitation drugs in Emergency Department should be carefully administered because amiodaron might be given only for those with VT without pulse or VF rhythm as initial cardiac rhythm. For the return to spontaneous circulation or ROSC, there is no meaningful correlation between categorical survival time (p>0.05) although there is a tendency that if there is ROSC, their categorical time may be ≥ 8 hours and those without ROSC, there is no survival time.

Thus, recommendations from researchers that it is important to conduct periodic and continuous training on management of patients with out of hospital cardiac arrest to those working in Emergency Department and the training must be inline with algorithm from American Heart Association (AHA). There is

also a need for the improvement of post cardiac arrest service in a hospitals and periodic training on basic life support especially CPR for people.

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