

Nicosia General Hospital (NGH) Cardiac Arrest Team (CAT). First years' Practice
and Outcomes

Marios Georgiou,² Christos Eftychiou¹.

Acknowledgements: Andreas Andreou¹, Andreas Michaelides¹, Kyriakos Yiangou¹,
Alexandros Deligeorgis¹, Petros Petrou¹, Theodoros Christodoulides¹, Panayiota
Georgiou¹, Loukia Makri³, Thalia Patsia⁴, Evagoras Nicolaides⁴, Michalis Minas¹.

¹ Cardiology Department, Nicosia General Hospital

² Resuscitation officer of Nicosia General Hospital

³ Statistic's officer A; Statistical Service of Cyprus

⁴ Nicosia General Hospital

Marios Georgiou

Resuscitation officer, Nicosia General Hospital, Cyprus

E-mail address: mariogr@spidernet.com.cy

ABSTRACT:

Aim: Nicosia General Hospital (NGH) implemented in 2007 a resuscitation policy. The aim of this study was to assess the frequency of cardiac arrest and resuscitation outcomes in NGH and assess any associations between the survival rate and the patient's characteristics.

Methods: We prospectively analyzed the data on all cardiac arrest calls in NGH between January and December 2007.

Results: The cardiac arrest team (CAT) was called 83 times. Cardiac arrest was identified in 69 calls while 4 calls were respiratory arrests. In 86% the initial rhythm was asystole/PEA and in 14% VF/VT. ROSC was achieved in 52% of the cases. Survival to discharge was achieved in 17.8% of the patients with arrest and in 14.5% of cardiac arrests. Patients with an initial rhythm of asystole/PEA were discharged in 5% and patients with VF/VT in 70%. About 36% of the patients less than 60 years old were discharged and 12% of the patients older than 60. The CAT arrived in 1.6 minutes, first shock in VF/VT was delivered in 1.5 minutes and the first adrenaline dose in asystole/PEA was given in 2.7 minutes.

Conclusions: It is more likely for our patients to survive to discharge if they are less than 60 years old, they are hospitalized in the cardiology department and the initial rhythm is VF/VT. Our outcomes are similar to survival rates in larger studies however points of improvement have been identified and interventions need to be done in order to improve documentation and outcomes of in hospital arrests.

Key words: cardiac arrest; resuscitation; cardiac arrest team

Introduction:

It is well known that most patients undergoing in-hospital cardiac resuscitation do not survive to hospital discharge (1). However successful cardiopulmonary resuscitation (CPR) depends on the availability of basic and advanced life support systems, the ability to immediate defibrillation and the quality of the CPR intervention (2). The traditional way of calling the physician on duty when a cardiac arrest is suspected, causes an unacceptable delay that may diminish the chance of survival (3). The European Resuscitation Council Guidelines for Resuscitation published in 2005 stress out the significance of early CPR and early defibrillation (4,5). We also know that the presence of at least one Advance Life Support (ALS) trained team member at in-hospital resuscitation efforts increases both short and long-term survival following cardiac arrest (6).

The Nicosia General Hospital (NGH) is a tertiary hospital, the largest in Cyprus with an Emergency Department (ED) that is on duty 24 hours every day. NGH had a capacity of 400 beds and 16828 patients were hospitalized during 2007. It does not include a pediatric or an obstetrics department. In October 2006, right after transfer to new premises, NGH attempted to implement its resuscitation policy and establish cardiac arrest teams (CAT) in order to optimize the response and outcome of in hospital cardiac arrests. Until then there was no official alert system of response to cardiac arrest, clinical wards were not appropriately equipped to effectively and timely treat cardiac arrests and there was no training system within the hospital for in hospital resuscitation. During the preparatory period that took place from 2004 until 2006, 120 doctors and 378 nurses were successfully trained in ALS so they could participate as members of the CAT. A resuscitation officer was appointed in January 2007. His major task was to fully implement the hospital's resuscitation policy. Among others he is responsible for the continuous education and maintenance of

skills of the trained staff. He is also responsible for the necessary equipment (crash trolleys) in every hospital ward and department. We need to mention that although there is a Do Not Attempt Resuscitation (DNAR) clause in the resuscitation policy, it is not implemented due to cultural and legal limitations.

Aim:

The aim of this study was to assess the frequency of cardiac arrest and resuscitation outcomes in Nicosia General Hospital; to determine the probability of an adult inpatient to sustain cardiac arrest, and be discharged alive. Furthermore we aim to assess the association between the survival rate and the patient's age and sex, the initial arrest rhythm, the site and time of cardiac arrest and witnessing of cardiac arrest. We also aimed to evaluate the effectiveness of in hospital resuscitation in order to detect ways of improvement.

Methods:

We prospectively analyzed the data on all cardiac arrest calls in Nicosia General Hospital between January and December 2007. The hospital as said above had a capacity of 400 beds and 16828 hospitalized patients during the year of observation. Data were collected using the Utstein style focusing on demographic characteristics, etiology and presentation of cardiac arrest, time and date, site, the presence of a witness, any specialized interventions before and after the arrest, timing of interventions, return of spontaneous circulation (ROSC) and outcomes of cardiopulmonary resuscitation. There were only two possible outcomes: died in hospital or discharged alive. The data were documented by the cardiac arrest team leaders and collected by the resuscitation officer.

When a patient collapses and an arrest is confirmed, the ward staff dials the number 3333. This is an internal line that is answered by the operator and used only for cardiac arrests. According to the policy the ward staff must be clearly stating the

ward, the level and room number where the arrest is taking place. The operator responds to the call immediately by calling the internal wireless telephone devices which all members of the CAT carry.

The team consists of a trainee in Cardiology (team leader), a trainee in Anesthesiology, a trainee in Internal medicine and a nurse; all ALS providers. The team leader is the one who gives instructions and decides on the CPR process. The anesthesiologist is responsible for the airway management. The trainees are never supervised in any arrest and in any time of the day. Patients from all the wards and departments of the hospital were included.

Cardiac arrest was defined as the cessation of cardiac mechanical activity as confirmed by the absence of signs of circulation. A witnessed cardiac arrest is one that is seen or heard by another person or an arrest that is monitored. ROSC was defined as the restoration of a spontaneous perfusing rhythm that results in more than an occasional gasp, fleeting palpated pulse, or arterial waveform (7).

Statistical analysis:

Statistical analysis was performed with the use of descriptive statistics. Means, standard deviations and 95% confidence intervals were used for continuous variables and frequency tables as well as crosstabulations were used to study categorical variables. Additionally, Student's t-test was used to examine the existence of statistically significant differences in continuous variables (age, arrival of the CPR team in minutes etc.) between the two outcome groups of patients (discharged and deceased). Fisher's exact test was performed to identify possible associations between categorical variables (outcome and: age, sex, existence of VF/VT etc.).

Results:

From January to December 2007, 83 arrest calls were registered. Ten calls were considered as false since no arrest was documented. Four calls were primary

respiratory arrests, the airway was secured with intubation and the patients were transferred to the Intensive Care Unit (ICU). Sixty-nine patients had no signs of breathing or circulation and were confirmed as cardiac arrests. The frequency of arrest in NGH is 4.34/1000 patients per year.

The mean age of patients was 70.8 years (CI 95%: 66.6-75.1). 21.2% of the cases were less than 60 years old, 48.5% were between 61 and 80 and 30.3% were older than 80. Most of the patients were male 56 (77%) and only 17 (23%) were female.

Most of the cardiac arrests were inpatients in the cardiology department: 14 (20.3%) in Coronary Care Unit (CCU) and 5 (7.3%) in cardiology ward. 14 (20.3%) patients had an arrest in the internal medicine wards, 9 (13%) in the ICU, 9 (13%) in the ED, 7 (10.1%) in the angiothoracic ward (ATH), 4 (4.3%) in the surgical ward, 2 (2.9%) in the orthopedic ward, 1 (1.5%) in the urology ward and 1 (1.5%) in the neurosurgery ward.

Most of the arrests (39.7%) occurred between the hours 0:00-7:59, 28.6% occurred between 8:00-15:59 and 31.7% between 16:00-23:59. The arrest was witnessed in 60 (82.2%) cases and not witnessed in 13 (17.8%).

The initial rhythm in cardiac arrests was ventricular fibrillation or pulseless ventricular tachycardia (VF/VT) in 10 (14%) cases and asystole or pulseless electrical activity (asystole/PEA) in 59 (86%).

ROSC was achieved in 36 (52%) cardiac arrests. ROSC was achieved in 90% of cases of VF/VT and 46% of asystole/PEA. 13 (17.8%) patients were discharged alive while 60 (82.2%) died in hospital. Among the 69 cardiac arrests 10 (14.5%) patients survived to discharge. 70% were discharged among patients with initial rhythm VF/VT and 5% with initial rhythm asystole/PEA.

The crash team arrived in 1.6 minutes (CI 95%: 1.31-1.79), first shock in VF/VT was delivered in 1.5 minutes (CI 95%: 0.87-2.1) and the first adrenaline dose in cases of

asystole/PEA was given in 2.7 minutes (CI 95%: 2.2-3.2). The airway was secured in 6.4 minutes (CI 95%: 4.4-8.4).

Associations:

Fisher's exact test indicated a highly significant association between the initial rhythm and the outcome of cardiac arrest. While the majority of patients (70%) who suffered VF/VT survived, a significantly lower proportion of patients with asystole/PEA (5%) survived the arrest (Fisher's exact test; $p < 0.001$). There was also a statistically significant association regarding the outcome of cardiac arrest and the age of patients. A proportion of 36% of patients in the age group of ≤ 60 years survived the cardiac arrest, whereas only 12% of the patients aged over 60 years survived (Fisher's exact test; $p = 0.046$). A significant association was also observed between the outcome of arrest and the department in which the arrest took place, as 32% of the patients that had the arrest in the Cardiology departments survived, compared to 8% of the patients who had the arrest in any other department of the hospital (Fisher's exact test; $p = 0.022$).

The sex of the patients was not associated with the outcome (Fisher's exact test; $p = 0.719$). There was no statistically significant association between the outcome and the time of the arrest. No statistically significant association was either observed between the outcome of arrest and the presence of a witness at the time of the arrest (Fisher's exact test; $p = 0.189$).

Discussion:

An important number of 73 arrests occurred in NGH during a year. Most of the in-hospital arrests occur in male patients and in the Cardiology Department. It is more likely for our patients to survive to discharge if they are less than 60 years old, they are hospitalized in the cardiology department and the initial rhythm is VF/VT. Our survival to discharge rate for patients with asystole/PEA is very low while the overall

survival rate of 17.8% is similar with larger studies (8,9). The “performance” of the cardiac arrest team is considered satisfactory since the team arrives at the site of the arrest in less than two minutes and delivers the first shock in VF/VT also in less than two minutes. Delivery of the first adrenaline dose is a time variable that should be improved while timing of securing the airway is affected by many factors and no conclusions should be extracted.

A limitation of our study is the small number of the patients since this is the first year that cardiac arrests are registered. Another limitation is that the data are collected by the cardiac arrest team members and so they may be biased. We also know from other studies that documenting time intervals is difficult. Even when a person was added to the resuscitation team as a data recorder, the time intervals during resuscitation were collected inaccurately or not at all (10, 11, 12). However the cardiac arrest chart was revised in order to make documentation easier and more accurate.

Interestingly none of the 14 cases (20.3%) of cardiac arrests that occurred in the Internal Medicine ward has survived to discharge. All of these cases had asystole or PEA as initial rhythm. In the Internal Medicine ward patients are not usually monitored constantly therefore these could be VF/VT that deteriorated in asystole. However there was no statistically significant difference in the rate of reported witnessing of the arrests in Internal Medicine wards even though there was a trend for higher rates of witnessing the arrest in the Cardiology departments (Fisher’s exact test; $p=0.094$). The low survival rate in medical wards might also be attributed to late recognition of clinical deterioration. There is strong evidence showing that delays in recognising deterioration or inappropriate management can result in late treatment, avoidable admissions to intensive care and in some cases, cardiac arrest and unnecessary deaths (13). Additionally these patients had a greater mean age and a worse medical condition with multiple problems and would probably represent

DNAR cases. Although there is a clause in the resuscitation policy, regarding DNAR, it is not currently implemented. This issue is at the moment under consideration from the hospital resuscitation committee in order to overcome cultural and legal limitations that will lead to its full implementation. In fact the implementation of DNAR policy will most probably affect the outcomes of in hospital resuscitation and the survival rate among the attempted cases for resuscitation will be higher (14). As it has been said before: resuscitation was never originally recommended for all patients, and its goal should be to “reverse premature death not prolong inevitable death”(15). Therefore we believe that a DNAR policy is necessary in NGH as well.

The use of a board was considered during CPR to improve the quality of chest compressions; however we strongly believe that this would cause interruptions or even delays in delivering early compressions. Prefilled syringes with adrenaline, atropine and amiodarone, is a way to improve the delivery time of the drugs. As stressed out above we need to shorten the time interval to the first adrenaline in asystole/PEA. Moreover, we are at the moment facing the challenge to transform the established CAT into Medical Emergency Team (MET) in order to prevent in hospital cardiac arrests.

Conclusion:

For the first time in Cyprus we have established a resuscitation policy in our largest hospital and this study represents the registry and outcomes from the first year of practice. It is more likely for our patients to survive to discharge if they are less than 60 years old, they are hospitalized in the cardiology department and the initial rhythm is VF/VT. Our outcomes are similar to survival rates in larger studies but are limited by the small number of our cases in this first year’s registry.

Points of improvement have been identified and interventions need to be done in order to improve documentation and outcomes of in hospital arrests. **Furthermore we**

would also recommend to the hospital management the implementation of DNAR policy and the transformation of CAT into MET. We believe that this analysis will be a useful tool for improving the quality and effectiveness of resuscitation service delivered not only in Nicosia General Hospital but in all hospitals around Cyprus.

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Table 1. Characteristics of patients with cardiac arrest in NGH

Characteristics	No (%) of patients
Sex	
men	56 (77%)
women	17 (23%)
Witness	
yes	60 (82.2%)
no	13 (17.8%)
Initial Rhythm	
VF/VT	10 (14%)
asystole/PEA	59 (86%)
Mean Age	70.8 years (CI 95%: 66.6-75.1)

Table 2. Significant associations of patients' characteristics and outcome

Characteristics	(% of patients)		
	discharged	died	p value
Age			
≤ 60	36%	64%	0,046
> 60	12%	88%	
Initial Rhythm			
VF/VT	70%	30%	<0,001
asystole/PEA	5%	95%	
Site			
Cardiology Department	32%	68%	0,022
All other Departments	8%	92%	

Table 3. Cardiac arrest team "performance" in minutes and 95% Confidence Intervals

	Mean Time in min	CI (95%)
Arrival of team	1.6	1.31-1.79
First shock in VF/VT	1.5	0.87-2.1
First adrenaline in asystole/PEA	2.7	2.2-3.2
Securing the airway	6.4	4.4-8.4

Table 4. Outcomes of in hospital resuscitation of Nicosia GH in 2007

	No	No (%) ROSC	No (%) Discharged
Respiratory arrests	4	4 (100%)	3 (75%)
Cardiac arrests	69	36 (52%)	10 (14.5%)
VF/VT	10	9 (90%)	7 (70%)
Asystole/PEA	59	27 (46%)	3 (5%)
Overall	73	40 (54.8%)	13 (17.8%)