

# Code blue practice in patient safety: Single center retrospective evaluation

Oznur Uludag<sup>1</sup>, Mevlut Dogukan<sup>1</sup>, Mehmet Duran<sup>1</sup>, Mehmet Tepe<sup>2</sup>, Aykut Direkci<sup>1</sup>

<sup>1</sup> Adiyaman University Faculty of Medicine, Department of Anesthesiology, Adiyaman, Turkey

<sup>2</sup> Adiyaman Training and Research Hospital, Anesthesiology and Reanimation Clinic, Adiyaman, Turkey

Copyright © 2019 by authors and Annals of Medical Research Publishing Inc.

## Abstract

**Aim:** Code Blue intervention is management system that ensure the most rapid and effective resuscitation of a patient in respiratory or cardiac arrest. The aim of the study was to evaluate the current code blue intervention in our hospital and to identify the practical problems associated with functioning of the code blue.

**Material and Methods:** The study population included all patients who code blue had been activated. Data were collected using code blue forms. It was evaluated the age, gender, time to reach the patient, CPR time, the initial rhythm and the results of the application.

**Results:** 188 patients who were given code blue in our hospital in one year were included in the study. The mean age of the patients was 73.4±14.45 years. 55% of the patients were male and 45% were female. The time for the code blue team to arrive was 3.32±1.97 minutes. Cardiopulmonary arrest was not present in 21.80 % of the blue-coded patients, and resuscitation was not required. Percent 78.20 patients were cardiac arrest and resuscitation was performed. The mean administration time of CPR was performed at 28.16±13.36 minutes. The initial rhythms were ventricular tachycardia / ventricular fibrillation (49%), followed by bradycardia (28%) and pulseless electrical activity / asystole (23%). Percent 21.08 patients returned to circulation and 78.19 % patients did not respond. The most common place for code blue was the palliative care unit.

**Conclusion:** The overall survival rate was 21.08 % in the hospital. The code blue application requires repeated education and a periodic assessment of site-specific problems. We concluded that the application of code blue carried out by a trained team is an essential standard in hospitals.

**Keywords:** Code blue; resuscitation; education

## INTRODUCTION

Code blue (CB) is emergency call and management systems for respiratory or cardiac arrest. CB is used for the same emergency situation and the same color all over the worldwide. The CB is referred to as an organization-based management system for initiating, realizing and ending the intervention of the responsible team identified. The CB is given by the healthcare worker. The CB team is a team that prevents clinical death in a fast, effective and safe way to provide life-saving support to patients. The CB team provides emergency response to patients, patients' relatives and all hospital staff (1).

In case of loss or deterioration of consciousness, stopping of breathing, stopping of circulation, or a shock state occurs, code blue call is made. The implementation process usually involves the creation of a professional

team, a readiness, the technological call system, the preliminary preparations and measures to be taken until the team reaches the patient. It also includes ready-made equipment, effective intervention, post-intervention management and records (2).

The CB intervention was first introduced in the United States at Bethany Medical Center in Kansas. The CB application was started in our country since 2008. "Patient and Staff Safety Regulations" by Ministry of Health has been made compulsory in Turkey (3). In-hospital cardiopulmonary arrest is common and delayed intervention is associated with a low survival rate. There are rapid response teams or code blue teams to reduce preventable deaths worldwide. After the CB call, it is essential that the CB team reaches the scene as soon as possible. The CB team needs to have the knowledge and skills in standardized treatment

**Received:** 28.05.2019 **Accepted:** 16.08.2019 **Available online:** 01.10.2019

**Corresponding Author:** Oznur Uludag, Adiyaman University Faculty of Medicine, Department of Anesthesiology, Adiyaman, Turkey

**E-mail:** uludagoznur@gmail.com

algorithms, such as Advanced Cardiac Life Support (ACLS). Non-medical skills, such as communication, leadership, team interaction, and task coordination, play an important role in code response as well as medical skills (4).

The objective of this study was to evaluate the CB implementation in tertiary care hospital. Secondary objectives were to identify the practical problems associated with functioning of the CB intervention.

## MATERIAL and METHODS

Our hospital in Turkey is a 400-bed tertiary care hospital. The hospital has CB team that responds to all in-hospital cardiac arrest alarms. The CB team in our hospital consists of a physician from the department of anesthesia, internal medicine and cardiology and an anesthesia technician. Physicians vary with monthly rotation. The CB team sentry list has been created during off-hours. All other healthcare professionals receive cardiopulmonary resuscitation (CPR) training every month. The code blue team works 24 hours a day, 7 days a week. Pager Device with SMS is used as a call system.

The roles and positions of the members of the code team of our hospital are clearly defined. Team leader is a person who has developed leadership skills and focused on team organization. The group organizes, monitors the team's performance and focuses on patient care. Team members know their roles and responsibilities. Competent in the skills required by the role, he was chosen from those who were willing to practice these skills. Cardiac arrest is defined by the absence of a detectable pulse, the patient's unresponsiveness, or any arrhythmia detected on the monitor. The CB post event notification forms have filled out regularly and delivered to the quality management unit.

This study is based on data collected between January 2018 and December 2018. The study protocol was approved by our Institutional Review Board. (Approval No:2019/1-15). It was retrospective observational descriptive study. Inclusion criteria included all patients who were resuscitated by the CB team of the hospital. A total of 224 CB calls were made. Patient records who treatment data were incomplete were excluded from the study. 188 patients who completed the code blue form were included in the study. Patients age, gender, the call given unit, team's arrival time to unit, CPR time, the initial rhythm and process were investigated.

The arrival time of the team was accepted as the time between the arrival of the alarm to the pager and the time between the arrival of the team and the takeover of the patient, and was recorded in minutes.

### Statistical Analysis

SPSS 16 program was used for statistical analysis. The Kolmogorov Smirnow test was used to determine whether the continuous variables exhibited normal distribution. Chi-Square test was used inter-group comparison of

discrete variables. Data were evaluated as mean  $\pm$  standard deviation (SD) and percent. Significance  $p < 0.05$  was evaluated.

## RESULTS

A total of 224 blue code calls were made in this period. 188 patients who completed the blue code form were included in the study. The mean age of the patients was  $73.4 \pm 14.45$  years. 55 % (n=104) patients were male and 45 % (n=84) patients were female. Although the rate of male patients was higher, as statistical there was no significant difference ( $p > 0.05$ ). The time for the code blue team to arrive was  $3.32 \pm 1.97$  minutes. In 21.80 % (n=41) of patients were general condition deterioration. In 78.20 % (n=147) of patients were made due to cardiopulmonary arrest. Percent 21.08 (n=31) patients returned to circulation. They were followed up in intensive care unit. 78.92 % (n=116) patients did not respond for CPR. The overall survival rate was 21.08 % (Table 1). The mean administration time of CPR was performed at  $21.14 \pm 13.36$  minutes. The initial rhythms were ventricular tachycardia (VT)/ventricular fibrillation (VF) (49%), followed by bradycardia (28%) and pulseless electrical activity (PEA)/ asystole (23%).

**Table 1. Age, gender, time of arrival to the scene, cause of code blue and response to CPR.**

Age	73,4 $\pm$ 14,45 year
Gender M/F	104(55%) / 84(45%)
The time for the Code Blue team to arrive	3.32 $\pm$ 1.97 minute
Code blue after deterioration of general condition	41 (21,80%)
Code blue after arrest	147 (78,20%)
Response to CPR, Live / Dead	31 (21,08%)/ 116 (78.92%)

The blue code call was made in the palliative care center with a maximum of 21.8 %. It is followed by internal medicine service with 18.6 %, chest diseases with 15.6 % and orthopedic service with 11.1%. A total of 32.9 % calls were made to the waiting rooms and all other units (Table 2).

**Table 2. Distribution of the code blue call by units.**

Units with code blue	N/ (%)
Palliative Care Center	41 (21,8%)
Internal Medicine Service	35 (18,6%)
Chest Diseases Service	29 (15,6%)
Orthopedics Service	21 (11,1%)
Waiting Rooms and Other Units	62 (32,9%)

## DISCUSSION

The CB intervention has become an important criterion in evaluating the service quality standards of hospitals. In-hospital cardiopulmonary arrest is a common condition worldwide, and very few of these patients can return home. In addition, delayed intervention and inadequate

resuscitation are other causes that contribute to the decrease of survival rates. The CB application is efficient in improving the resuscitation efforts and survival rates after in-hospital cardiac arrest. The first step in CPR applications is the early recognition of cardiac arrest (1,2).

When male-to-female ratios are compared in hospital-based arrests, males were required CPR more than females. The ratio of male to female in the literature varies between 56-69.9 % / 30.2-43.1% (5,6). The male / female ratio in our study was consistent with the literature. In the evaluation of the patients who were given a blue code call 104 patients (55%) were male and 84 (45%) patients were female.

In 2000, the American Heart Association (AHA) adopted the guide to intervene in cardiac arrest for less than 2 minutes to provide the first electrical shock (7). It has been shown that starting CPR in 1.5-2 minutes from different guides is more successful than starting CPR in more than 5 minutes (8). Esen et al., the time of arrival of code blue team to the scene was 3.45 minutes and death rate found to be 58.4% (9). Sandroni et al. reported that the arrival time in non-monitored areas was 3.98±1.73 minutes (10). The time for the code blue team to arrive was 3.32 ± 1.97 minutes in our study.

Peberdy et al. were reported 44% of adult in-hospital cardiac arrest victims had a return of spontaneous circulation; 17% survived to hospital discharge (11). The similar study, 620 patients were examined retrospectively. 422 patients had cardiac arrest and 198 patients had medical emergencies. Overall survival was found to be 26%. Survival was reported as 11.13% in patients with cardiac arrest. Factors such as age, rhythm presentation and duration of CPR have been reported to have a significant effect on survival (12). In another study, they were reported that the rate of CPR was 76.5 % in the hospital. Respiratory failure was the most common cause of CPR (30.8%). Percent 95.4 of all patients were reported to have died (13). In-hospital cardiac arrest mortality rates are as high as 85% (14). Survival rates for in-hospital arrests vary between 13-28.5% (15) and 35% (5,11). The survival rate of 21.08% in our study was consistent with the literature.

Oğuztürk et al. were reported that cardiac rhythm observed as ventricular fibrillation in 32 patients (45.7%) and asystole 28 patients (40%) (6). Sandorini et al. reported that the initial ECG rhythm recorded on the monitor was asystole 46%, VF 28%, electromechanical dissociation 22% and VT 4% (10). Nadkarni et al. reported that rhythm rates were 23% VF / VT and 35% asystole (15). The rhythms were VT / VF (49%), followed by bradycardia (28%) and pulseless electrical activity (PEA)/ asystole (23%) in our study.

Although there are code blue teams in our country and in many parts of the world, mortality rates are high. In our study, the time to reach the patient was 3.32 minutes. We believe that the characteristics of our hospital building are effective in the long duration. 78.1 % of patients were made due to cardiopulmonary arrest and the mortality rate

of patients were 61.7 %. The mean administration time of CPR was performed at 28.16 ± 13.36 minutes. In our study, the call for blue code was given in palliative care center with a maximum of 21.8 %. In palliative care, the aim is to take the approved life and the accepted death in the normal process and to meet the needs of the patient in this process.

There are 12 beds in our palliative care center. Patients who are not admitted to intensive care can also be admitted to this center except for palliative care patients. Therefore, code blue call numbers were found to be high in our palliative care center.

In hospital cardiac arrests are common and delayed treatment is associated with a lower survival rate and poor neurological outcomes. However, early recognition of at-risk situation is important for the safety of the patients. Maintenance in critical patients should be increased. Heart rate, blood pressure, respiratory frequency and changes in consciousness level should be detected early and precautions should be taken. All personnel should be provided with continuous training on resuscitation. Palliative care centers should be provided according to the World Health Organization proposal.

Our study has several limitations because it is a single-center, retrospective, nonrandomized, observational study. This study has taken only patients of adult. No pediatric and pregnant cases were reported in our hospital because they did not have pediatrics and obstetrics clinics. Therefore, the survival pattern adult versus pediatric age group could not be studied. Resuscitation done in the intensive care unit and operating room were not evaluated. We were unable to analyze the effect of the primary diagnosis and comorbidities on the survival.

The results of the study are unique to our hospital and our health care system. However, this study identified the shortcomings in the records and the inability to record the findings of the patient before the CB intervention phase or subsequent follow-up were noticed.

## CONCLUSION

As problems and solutions are supported and shared with such work, the effectiveness and efficiency of CB implementation will increase. In addition, long-term follow-up and more detailed studies are needed to monitor survival rates in the medium and long term. We concluded that the intervention of code blue carried out by a trained team is an essential gold standard in hospitals.

*Competing interests: The authors declare that they have no competing interest.*

*Financial Disclosure: There are no financial supports*

*Ethical approval: This study was approved by Adiyaman University Ethical Committee with the project number: 2019/1-15*

*Oznur Uludag ORCID:0000-0002-6017-5836*

*Mevlut Dogukan ORCID:0000-0002-4890-758X*

*Mehmet Duran ORCID:0000-0001-7568-3537*

*Mehmet Tepe ORCID: 0000-0002-2596-1284*

*Aykut Direkci ORCID:0000-0001-7784-7267*

## REFERENCES

1. Jones DA, Mitra B, Barbetti J, et. al. Increasing the use of an existing medical emergency team in a teaching hospital. *Anaesth Intensive Care* 2006;34:731-5.
2. Ornato JP, Peberdy MA, Reid RD, et al. Impact of resuscitation system errors on survival from in-hospital cardiac arrest. *Resuscitation* 2012;83:63-9.
3. Resmi Gazete (2011), Sağlık Bakanlığı, Hasta ve Çalışan Güvenliğinin Sağlanmasına Dair Yönetmelik. Resmi Gazete 06/04/2011, No:27897.
4. Field JM, Hazinski MF, Sayre MR, et. al. American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation* 2010;122:640-56.
5. Mendes A, Carvalho F, Dias C, et. al. In-hospital cardiac arrest: factors in the decision not to resuscitate. The impact of an organized in-hospital emergency system. *Rev Port Cardiol* 2009;28:131-41.
6. Oğuztürk H, Turtay MG, Tekin YK, et. al. Acil serviste gerçekleşen kardiyak arrestler ve kardiyopulmoner resüsitasyon deneyimlerimiz. *Kafkas J Med Sci* 2011;1:114-7.
7. Brindley PG, Markland DM, Mayers I, et. al. Predictors of survival following in-hospital adult cardiopulmonary resuscitation. *CMAJ* 2002;167:343-8.
8. Villamaria FJ, Pliego JF, Wehbe-Janek H, et al. Using simulation to orient code blue teams to a new hospital facility. *Simul Healthc* 2008;3:209-16.
9. Esen O, Esen H, Öncül S, et. al. Code Blue Practices and Evaluation of Results in a Training and Research Hospital. *J Kartal TR* 2016; 27:57-61.
10. Sandroni C, Ferro G, Santangelo S, Tortora F, Mistura L, Cavallaro F, Caricato A, Antonelli M. In-hospital cardiac arrest: survival depends mainly on the effectiveness of the emergency response. *Resuscitation*. 2004; 62:291-7.
11. Peberdy MA, Kaye W, Ornato JP, et. al. Cardiopulmonary resuscitation of adults in the hospital: a report of 14720 cardiac arrests from the National Registry of Cardiopulmonary Resuscitation. *Resuscitation* 2003; 58:297-08.
12. Monangi S, Setlur R, Ramanathan R, et. al. Analysis of functioning and efficiency of a code blue system in a tertiary care hospital. *Saudi J Anaesth* 2018;12:245-9.
13. Vancini-Campanharo CR, Vancini RL, de Lira CA, et. al. Characterization of cardiac arrest in the emergency department of a Brazilian University Reference Hospital: A prospective study. *Indian J Med Res* 2016;144:552-9.
14. Mohnle P, Hüge V, Polasek J, et al. Survival after cardiac arrest and changing task profile of the cardiac arrest team in a tertiary care center. *Scientific World Journal* 2012;2012:294512.
15. Nadkarni VM, Larkin GL, Peberdy MA, et al. First documented rhythm and clinical outcome from in-hospital cardiac arrest among children and adults. *JAMA* 2006;295:50-7.