**Original Research Article**

# Three-year retrospective analysis of code blue calls: single center experience

**Muge Arikan\*, Emre Meric, Abdullah Yesilkaya, Busra Nur Tasdelen, Ayse Akhan**

Department of Anesthesiology, Faculty of Medicine, Karabuk University, Karabuk, Turkey

**\*Correspondence:**
Dr. Muge Arikan,
E-mail: mugearikan@hotmail.com.tr

**ABSTRACT**

**Background:** The code blue is a universal emergency system used to alert the CB team for patients in cardiac or respiratory arrest. The purpose of this study is to evaluate CB calls in our hospital and determine the effectiveness and deficiencies of the application.
**Methods:** After receiving approval from the ethics committee, we analyzed retrospectively the CB call forms in our hospital between January 2020 and January 2024. The demographic data of the patients, CB call time and locations, the arrival time of the team, medical interventions, cardiopulmonary resuscitation time, outcomes of the calls and true-false calls rate were recorded.
**Results:** We had 376 CB calls in the study period. The mean arrival time of the team was 1.58±0.62 minutes. Most of the CB calls were given in intensive care units (140 patients, 37.23%), internal medicine services (50 patients, 13.30%), followed by palliative care unit (47 patients, 12.50%). Most of the CB calls (236 calls, 62.77%) were during off times. The rate of false CB calls was found to be %15.96. Of the 316 patients in the true CB codes, 198 patients were transferred to the ICU and 118 patients died.
**Conclusions:** We found that CB calls were most frequently given from ICU's during off hours. We think that the lack of a night duty doctor in the ICU, especially in rural hospitals like ours, led to this result. Each center should analyze CB calls at regular intervals and educational programs should be planned for these deficiencies.

**Keywords:** Code blue systems, Cardiopulmonary resuscitation, Mortality

## INTRODUCTION

Code Blue (CB) is a universal emergency code that was used for the first time at Bethany medical center in USA. It has been implemented in our country since 2009 and became mandatory with legal regulations in 2011.[1,2] The main purpose of CB is to provide basic life support by quickly reaching the patient who requires resuscitation, most often due to cardiopulmonary arrest (CPA).[3] Our hospital has a CB team that consists of an anesthesiologist, an anesthesia technician and security guard. After the intervention is completed, CB forms are filled out by the anesthesiologist. The morbidity and mortality rates can be reduced by rapidly recognizing and intervening in-hospital cardiopulmonary arrests.[4] There are many studies in the literature highlighting the importance of this issue. However, the rates of false CB calls are reported to be very high, especially in studies reported from our country.[5-8] We had revealed similar results in our previous study, and in this context, we implemented a training program on basic life support for all hospital staff.[9] CB practice is an important quality

criterion for hospitals. It is recommended that each hospital conduct these evaluations at regular intervals, in order to determine the effectiveness and deficiencies of CB applications. In this study, we retrospectively evaluated the CB calls given in our hospital. We aimed to determine the accuracy of CB calls, demographic characteristics of the patients, applied interventions and their outcomes.

## METHODS

This retrospective study was conducted in Karabuk University Hospital in Karabuk, Turkey, after the research protocol was approved by the local ethics committee (No:2024/1669). The study was carried out in accordance with the Declaration of Helsinki. All CB calls between January 2020 and January 2024 in our hospital were evaluated. Data were obtained by examining CB forms which are completed by the anesthesiologist as the team leader. During the specified study period, 389 calls were given. Patients younger than 18 years of age and files with missing data were excluded. 376 calls were included in the research. We recorded demographic data of patients (age, and gender), the time of the calls and locations, the arrival time of team, medical interventions and cardiopulmonary resuscitation (CPR) time. The outcomes of patients classified as exitus and transferred to Intensive Care Units (ICU) and accuracy of calls were also recorded. According to Utstein model, a patient who does not need basic life support or advanced life support is defined as a false arrest. The time of the calls was grouped as daytime (weekdays between 08:00-16:00), off hours (weekdays between 16:00-08:00, weekend and holidays). When the team arrived, the patient's current rhythm was classified as shockable or non-shockable. It was recorded whether a shockable rhythm occurred during CPR. Statistical analyses were carried out using SPSS for Windows. Measurable variables were presented as mean (X)±standard deviation (SD) and qualitative variables were presented with numbers and percentages.

## RESULTS

There were a total of 389 CB calls during the study period. Thirteen patients were excluded; 9 of them were due to missing data and 4 patients were under 18 years of age. The mean age of the remaining 376 patients was 72.98±15.42 years. 204 of the patients were male and 172 were female. The mean arrival time of the team was 1.58±0.62 minutes (min). Most of CB calls were during off hours (236 calls, 62.77%). In our hospital, the most code was given in ICU's (140 calls, 37.24%). Demographic feature of the patients and the general characteristics of CB calls were summarized in (Table 1). The number of true CB calls was 316 (84.04%), and false CB calls was found to be 60 (15.96%).

The most common causes of false CB calls were respiratory problems and seizures. The whole causes of true and false CB calls were summarized in the (Table 2).

The rhythms seen in the patient, the CPR time and medical interventions applied in the 316 patients who were given the true CB calls were shown in (Table 3). Of the 316 patients in the true CB codes, 198 patients were transferred to the ICU and 118 patients died.

**Table 1: Demographic feature of the patients and the general characteristics of CB calls.**

| Parameters | Observations |
|---|---|
| **Age (years), mean±SD** | 72.98 ±15.42 |
| **Gender, N (%)** | |
| Female | 204 (54.26) |
| Male | 172 (45.74) |
| **CB calls time, N (%)** | |
| Day time | 140 (37.23) |
| Off hours | 236 (62.77) |
| **Units given CB calls, N (%)** | |
| Intensive care units | 140 (37.24) |
| Internal medicine services | 50 (13.30) |
| Palliative care unit | 47 (12.50) |
| Surgery services | 35 (9.30) |
| Cardiology | 22 (5.85) |
| Pulmonary diseases | 19 (5.05) |
| Neurology services | 12 (3.20) |
| Polyclinics | 10 (2.66) |
| Others | 41 (10.90) |

**Table 2: The causes of true and false CB calls.**

| Parameters | N (%) |
|---|---|
| **True** | 316 (84.04) |
| **Cardiac arrest** | 274 (86.71) |
| **Respiratory arrest** | 42 (13.29) |
| **False** | 60 (15.96) |
| **Desaturation** | 21 (35.00) |
| **Dyspnea** | 10 (16.67) |
| **Seizure** | 8 (13.33) |
| **Syncope** | 7 (11.67) |
| **Hypotension** | 5 (8.33) |
| **Confusion** | 5 (8.33) |
| **Conversion** | 4 (6.67) |

**Table 3: The medical interventions applied in true CB calls.**

| Parameters | Observations |
|---|---|
| **CPR time (min), mean±SD** | 22.42±12.88 |
| **Rhythm, N (%)** | |
| Asystole | 219 (69.30) |
| Sinus rhythm | 24 (7.60) |
| Bradycardia | 30 (9.50) |
| Ventricular fibrillation | 16 (5.06) |
| Ventricular tachycardia | 14 (4.44) |
| Pulseless electrical activity | 13 (4.10) |
| **Defibrillation, N (%)** | |
| Yes | 88, (27.85) |
| No | 228 (72.15) |

## DISCUSSION

The rapid recognition and effective intervention decrease the morbidity and mortality rates in patients with CPA. Since delayed intervention worsens neurological sequelae, starting CPR within 3 min is very vital for these patients.[3] According to the guideline of the American heart association (AHA), it is emphasized that intervening in cardiac arrest in less than 2 min and giving the first electrical shock increases the survival rate.[10] The times for CB teams to arrive at the scene have been reported as 2.83±1.30 min, 2.72 min, 1.10 min, and 2.02 min, in studies reported from Türkiye.[6,11-13] In the present study, the mean arrival time was 1.97±0.72 min. Our result is consistent with the literature and is below 3 minutes, which is considered a quality indicator.[14] In studies evaluating the timing of CB calls, Pattnaik et al. stated that 72.46% of the CB calls were during off times.[15] In our previous study, we had found this rate as 62.67%.[9] Baytar et al found that 69% of the CB calls were in off times.[16] In our study, 62.77% of the CB calls were in off times, compatible with the literature. Uludag and Kayır reported that the services most frequently given CB calls were palliative care unit, internal medicine and pulmonary diseases services, respectively.[17,18] In our hospital, CB calls are applied in the 1st and 2nd level ICU's. We found that the ICU gave the most CB calls. We think that the reason for the high number of CB calls in the 1st and 2nd level ICU's is the lack of a physician on duty. It is important to reduce false call rates in terms of the effectiveness of the CB system and reducing workforce loss. The rate of false CB calls has been reported as 9.2%-84.5% in various studies.[4,7,8] In a study performed by Kaykısız et al the rate of false CB calls was 45%.[19] Kaernested et al found this rate as 61%.[20] Canural et al reported that the false code rate as 61%.[1] In our previous study, the rate of false calls was 13.33%.[9] In our current study, the false CB rate was 15.96%. Varied results have been reported in studies evaluating the rhythms seen in CB calls. The most common rhythm has been reported as asystole in several studies.[21,22] In their study, Baytar et al reported that the first cardiac rhythm was non-shockable in 90.5% of cases, and the CPR time was 21.94±13.67 min.[16] We only considered true CB calls and found a similar result. We found the rate of non-shockable rhythms to be 74%, and CPR time was 22.42±12.88 min. Unfortunately, the mortality rate is very high for these patients. According to the outcomes of the patients, Pembeci et al found that the survival rate was 49%, Bakan et al. reported this rate as 37.92%, Özütürk et al reported that 60.8% of 205 patients survived.[12,23,24] In our study, the survival rate was found to be 62.66%, consistent with the literature. The most important limitations of our study are its single-center and retrospective nature. Additionally, long-term outcomes of patients transferred to ICU could not be evaluated. In many centers, the CB call system is not implemented in emergency departmens and ICU's. However, in rural hospitals like ours, there is no physician on duty in the ICU. In our study, the most frequently coded unit was ICU. We think this is one of the limitations of our study.

## CONCLUSION

We found that CB calls were most frequently given from ICU's during off hours.These findings draw attention to importance of maintaining this system uninterruptedly. Each center should analyze CB calls at regular intervals. The educational programs and regulations should be made to address the identified problems.

## REFERENCES

1. Canural R, Gökalp N, Yıldırım K, Şahin M, Korkmaz A, Şahin N, et al. Sağlık Hizmetlerinde Hasta Güvenliği: Mavi kod Uygulaması Uluslararası Sağlıkta Performans ve Kalite Kongresi Bildirileri Kitabı; Sağlık Bakanlığı, Ankara. 2009;772(2):525-40.
2. Regulation on the provision of Patient and Staff Safety. Available at: https://kalite.saglik.gov.tr/ content/files/ duyurular_2011/2011/06 nisan_2011/ 4hcgyonetmelik.pdf. Accessed on 15 January 2016.
3. Field JM, Hazinski MF, Sayre MR, Chameides L, Schexnayder SM, Hemphill R, et al. Part 1: executive summary: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation. 2010; 122(18):640-56.
4. Sahin KE, Ozdinc OZ, Yoldas S, Goktay A, Dorak S. Code Blue evaluation in children's hospital. World J Emerg Med. 2016;7(3):208-12.
5. Bayramoğlu A, Cakir ZG, Akoz A, Ozogul B, Aslan S, Saritemur M. Patient-staff safety applications: the evaluation of blue code reports. Eurasian J Med. 2013;45(3):163-6.
6. Çakırca M, Kılcı O. Evaluatıion of blue code data in a great training and research hospital: additives and deficiencies. JARSS. 2018;26(3):132-6.
7. Bişkin Çetin S, Sezgin MG, Coşkun M, Sarı F, Boztuğ N. Evaluation of Code Blue Notifications and Their Results: A University Hospital Example. Turk J Anaesthesiol Reanim. 2023;51(2):105-11.
8. Demirci MA, Fırat CA, Kayhan Z. Hastanemizde Mavi Kod Çağrılarının Retrospektif Olarak Değerlendirilmesi. JARSS. 2018;26(2):86-94.
9. Arikan M, Ates A. Yeni Bir Eğitim Hastanesinde Mavi Kod Sisteminin Etkinliği Ve Sonuçlarının Değerlendirilmesi. Gaziosmanpaşa Tıp Dergisi. 2019; 11(2):105-12.
10. Abella BS, Alvarado JP, Myklebust H, Edelson DP, Barry A, O'Hearn N, et al. Quality of cardiopulmonary resuscitation during in-hospital cardiac arrest. JAMA. 2005;293:305-10.

11. Murat E, Toprak S, Doğan DB, Mordoğan F. The code blue experiences: gains, problems and troubleshooting. Med Sci. 2014;3(1):1002-12.
12. Özütürk B, Muhammedoğlu N, Dal E, Çalışkan B. Evaluation of code blue implementation outcomes. Med Bull Haseki. 2015;53(3):204-8.
13. Çiçekci F, Selçuk Atıcı S. The evaluation of the results of cardiopulmoner resusitation associated with code-blue. J Gen Med. 2013;23(3):70-6.
14. General Directorate of Health Services, Department of Quality in Health, Accreditation and Employee Rights. Available at: https://shgmkalitedb.saglik. gov.tr/TR-52461/guncel-standartlar-excel-versiyon.html. Accessed on 25 June 2021.
15. Pattnaik SK, Ray B, Nayak J, Prusty A, Sinha S. Code blue protocol: observation and analysis of results over last 3 years in a new tertiary care hospital. Intensive Care Med Exp. 2015;3(1):A205.
16. Baytar M, Baytar C. Code Blue, Is It Really Blue?. Van Med J. 2022;29(2):212-6.
17. Uludag O, Dogukan M, Duran M, Tepe M, Direkci A. Code blue practice in patient safety: Single center retrospective evaluation. Ann Med Res. 2019;26(9):1922-5.
18. Kayır S, Akdağlı Ekici A, Doğan G. A 4-year analysis of code blue emergency protocol in a tertiary care hospital. Pam J. 2020;13(2):311-9.
19. Kuday Kaykısız E, Tongün A, Sönmezsoy M, Güven R. Code Blue in Theory Versus Daily Practice: Data from a Secondary Care Hospital. Eurasian J Emerg Med. 2017;16:157- 61.
20. Kaernested B, Indridason OS, Baldursson J, Arnar DO. In-hospital cardiopulmonary resuscitation at Landspitali University Hospital in Reykjavik. Laeknabladid. 2009;95(7):509-14.
21. Ozmete O. Bir üniversite hastanesinde mavi kod uygulamasının sonuçları. Cukurova Med J. 2017; 42(3):446-50.
22. Ozgur Y, Albayrak M. Göğüs Hastalıkları ve Göğüs Cerrahisi Eğitim ve Araştırma Hastanesinde mavi kod uygulamasının sonuçları. DEU Tıp Derg. 2020;34(1): 35-42.
23. Pembeci K, Yildirim A, Turan E, Buget M, Camci E, Senturk M, et al. Assessment of the success of cardiopulmonary resuscitation attempts performed in a Turkish university hospital. Resuscitation. 2006; 68(2):221-9.
24. Bakan N, Karaören G, Tomruk ŞG, Keskin Kayalar S. Mortality in Code Blue; can APACHE II and PRISM scores be used as markers for prognostication? Ulus Travma Acil Cerrahi Derg. 2018;24(2):149-55.