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ORIGINAL RESEARCH **CPR / LIFE SUPPORT**

Comparison of code blue application and results in a training and research hospital before and during the COVID-19 pandemic

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Abstract

Background & Objective: Code blue is an emergency management system that allows for a rapid professional response to the patients of cardiopulmonary arrest (CPA) in hospitals. The time to initiate the call and the response of the 'Code Blue Team' may vary in different hospitals, and it me be linked with the survival of the victim. We examined and compared the code blue application utilized in our hospital before and during the COVID-19 pandemic.

Methodology: Code Blue Call (CBC) logs from March 01, 2018 to March 31, 2022 were retrospectively analyzed. The study period was divided into two parts: March 01, 2018–February 28, 2020 (Group I, pre-pandemic period) and March 01, 2020–March 31, 2022 (Group II, pandemic period).

Results: During the study period, a total of 1542 CBC's were received, of which 837 (54.3%) were 'true' CBC's. Of the 837 true CBC's included in the study, 477 (56.7%) were for male patients and 360 (43.3%) were for the females. We evaluated the month-wise distribution of the CBC's; the month with the highest number of calls in Group I was January 2019 (n = 29, 17.3%), while in Group II it was December 2020 (n = 59, 23.1%). The arrival time of the code blue team was significantly different between the groups, e.g., 3.15 ± 0.52 vs. 3.81 ± 0.58 min in Group I vs. Group II respectively.

Conclusion: The intervention times of the code blue team and the success of cardiopulmonary resuscitation were observed to be comparable during the pre-pandemic and pandemic periods. The duration of commencement of intervention is important for the efficacy of cardiopulmonary resuscitation during a pandemic.

Abbreviations: CBC: Code Blue Call; CBT: code blue team; COVID-19: Coronavirus Disease-19; CPA: cardiopulmonary arrest

Key words: COVID-19; CPR; Code Blue; Pandemic

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1. Introduction

In cases of cardiopulmonary arrest (CPA) in hospital settings, code blue is an emergency management system that allows for a fast and effective professional response to the patient, patient's family and healthcare personnel. Worldwide, hospital emergency codes are used to reduce in-hospital fatalities and to promptly notify the healthcare personnel of an emergency, .[1] The application of the code system began in the United States of America, with the blue being accepted internationally as

the emergency color code.[2] In our country, according to a communiqué issued by the Ministry of Health in 2009, the code blue emergencies applications are mandatory in every healthcare institution for the patient and employee safety.[3]

The code blue call (CBC) allows all the healthcare personnel to quickly notify the code blue team (CBT) via a call system in the event of an emergency and the team is expected to arrive at the scene as quickly as possible. The CBT consists of a specialist physician experienced and trained in cardiopulmonary resuscitation (CPR), an anesthetic technician, a nurse, and a security guard.[3]

The development of hypoxemic respiratory failure, cardiac damage, ventricular arrhythmias, and shock as a result of acute respiratory distress syndrome (ARDS) in COVID-19 patients worsens the course of the disease and makes patients susceptible to CPA.[4,5] The great majority of COVID-19-related deaths occur in hospitals, and when CPA develops, CBTs intervene in patients, as they do in other CPA scenarios. Because CPR efforts in these patients include interventions that induce aerosolization, methods for CPA interventions in dangerous COVID-19 patients have been established. The Turkish Resuscitation Association, in collaboration with the European Resuscitation Council, has issued a resuscitation guide in our country. However, there are measures in these guidelines' algorithms that may create delays in COVID-19 patients' therapies.[6-8]

We compared code blue applications during the COVID-19 pandemic to those during the pre-pandemic period in terms of application results.

2. Methodology

After obtaining permission from the Ministry of Health, the Ondokuz Mayis University Clinical Research Ethics Committee granted approval (Dated: April 14, 2022, No. 2022/184) for the study. This retrospective, single-center study comprised the data of patients who received a code blue call while hospitalized in the wards of Samsun Training and Research Hospital between March 01, 2018 and March 31, 2022.

Code blue calls are generated in our hospital at the telephone line (2222) designated for the code blue activation. Notifications are forwarded to pagers of the code team. This system's operating principle is based on the telephone network's ability to transmit radiofrequency signals to the pager's location at the time of the phone call. In the event that the system is not operational or if there is uncertainty, notification can be made by activating the announcement system or directly calling the code team via the switchboard. Using this technology, code blue information is transmitted directly to the computer.

Our research is divided into two periods. On March 11, 2020, the Ministry of Health reported the detection of the first COVID-19 case in our country. Consequently, this date served as the dividing line between the groups of our study. Group I (pre-pandemic period) includes CBC's received between March 01, 2018 and February 28, 2020, whereas Group II (pandemic period) includes calls received between March 01, 2020 and March 31, 2022. In terms of the objectivity of the evaluation, the study was designed so that both groups were of the equivalent time period.

Only CBC's from ward patients were included in analysis. Calls from emergency rooms, operating rooms, and intensive care units where authorized CPR providers were present as well as calls from outpatient clinics, were excluded from the study. Data was collected from the code blue information system and code blue post-event notification forms. Age and gender of the patients, service or unit where the call was given, date and time of code blue, time of arrival of the CBT to the scene (time between the issuance of the CBC and the arrival of the CBT and the start of the intervention to the patient), status of the call (true call: patient required CPR, false call: patient did not require CPR) and the outcome of CBT intervention were noted.

Statistical Analysis

The Shapiro-Wilk test was used if data was normally distributed. Student's t-test was used to compare normally distributed variables in two independent groups. One-way analysis of variance (ANOVA) and Tukey's multiple comparison tests were utilized to compare more than two independent groups. The Chi-Square test was used to evaluate at the relationship between two or more qualitative variables. For numerical variables, the mean and standard deviation were provided as descriptive statistics, and for categorical variables, the number of cases and the percentage of cases were given. For statistical analysis, the SPSS Windows version 23.0 package program was used, and $P < 0.05$ was accepted to be statistically significant.

3. Results

A total of 1542 CBC's were received during the study period, of which 837 (54.3%) were true calls. When the distribution of 837 true calls included in the study was examined; 477 (56.7%) of the patients were male and 360 (43.3%) were female. The mean age of the patients was 71.99 ± 12.61 y (71.19 ± 12.35 y for men and 72.28 ± 12.94 y for women). Comparisons of true code blue patients' demographic data by group are shown in Table 1. There was no statistically significant difference with regards to age ($P = 0.381$) and gender ($P = 0.193$) and comorbidities ($P = 0.116$) of the patients between the groups.

Table 1: Comparison of true code blue patients' demographic data

Variable	Group I (n = 346)	Group II (n = 491)	p
Gender			
Male	188 (54.3)	289 (58.9)	0.193
Female	158 (45.7)	202 (41.1)	
Age (y)	71.22 ± 12.48	72 ± 12.71	0.381
Comorbidities			
Malignancy	214 (61.9)	206 (42)	0.116
Respiratory Failure	110 (32.1)	221 (45.1)	
Diabetes Mellitus	131 (37.9)	180 (36.5)	
Hypertension	115 (33.3)	169 (34.5)	
Kidney failure	112 (32.4)	133 (27.1)	
Heart failure	89 (25.6)	108 (22.1)	
Coronary Heart Disease	77 (22.4)	91 (18.6)	
Sepsis	75 (21.8)	75 (15.3)	
Pulmonary embolism	31 (9.2)	50 (10.2)	

Data presented as n (%) or Average ± SD

True, false and total CBC's per month are presented in Table 2. In the pre-pandemic period, a total of 656 CBC's were made, of which 346 (52.7%) were identified as true CBC's and 310 (47.3%) as false CBC's (Rate: 346/310 = 1.11). During the pandemic period, 491 (55.4%) of the 886 CBC's were recorded as true calls and 395 (44.6%) as false calls (Rate = 1.24). In Group II, both true and false call rates increased significantly compared to the previous period.

When the distribution of CBC's according to months is analyzed; in the pre-pandemic period, the highest number of true calls was observed in January 2019 (n = 29, 17.3%), while the month with the highest number of false calls was December 2018 (n = 31, 27.9%). While during the pandemic period, the highest true calls were noted in December 2020 (n = 59, 23.1%), and the highest number of false calls (n = 24, 11.4%) were made in December 2020 (Figure 1).

The distribution of true CBC's in relation to time of the day is presented in Table 3. The number of CBC's was similar during working hours (between 08-16 h) and outside working hours (between 16-08 hours) in both periods (P = 0.980). There was no significant difference in the number of calls according to time periods in both periods and in total (P = 0.677).

The average time taken for the CBT to arrive at the emergency location was similar in the pre-pandemic and pandemic period (3.15 ± 0.52 min vs 3.81 ± 0.58 min, P > 0.05) (Figure 2).

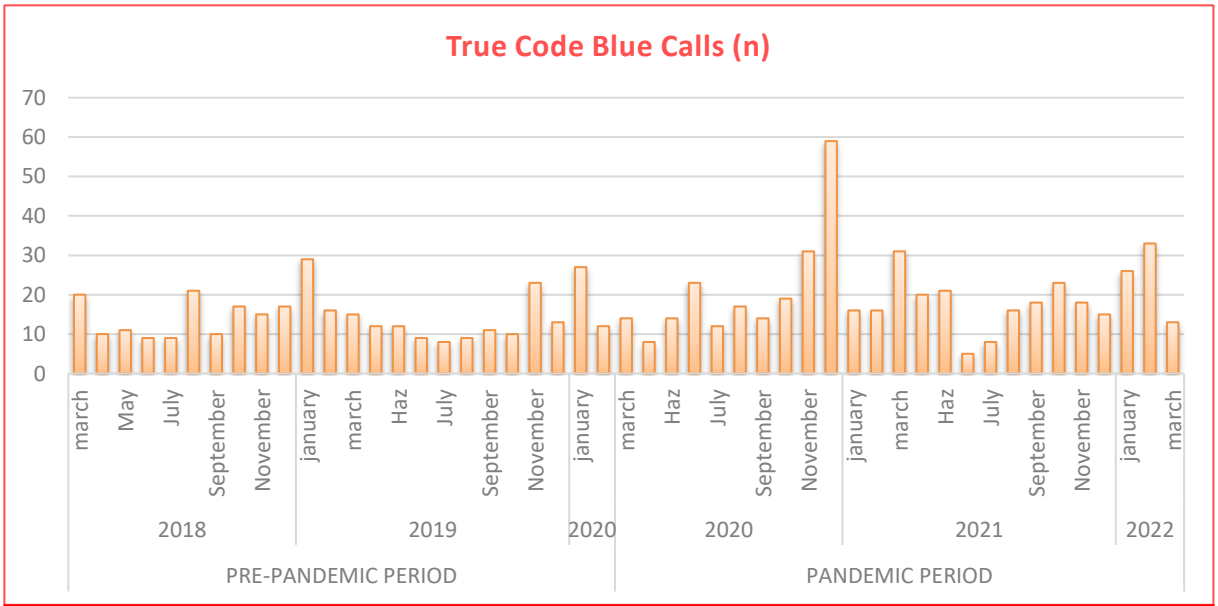

Figure 1: Number of true code blue calls before and during the pandemic

Table 2: Code blue calls distribution by month. Data given as n (%)

Period	Year	Month	True call	False call	Total
PRE-PANDEMIC PERIOD	2018	March	20 (11.7)	11 (9.9)	31 (10.99)
		April	10 (5.8)	7 (6.3)	17 (6.03)
		May	11 (6.4)	3 (2.7)	14 (4.96)
		June	9 (5.3)	9 (8.1)	18 (6.38)
		July	9 (5.3)	3 (2.7)	12 (4.26)
		August	21 (12.3)	3 (2.7)	24 (8.51)
		September	10 (5.8)	3 (2.7)	13 (4.61)
		October	17 (9.9)	7 (6.3)	24 (8.51)
		November	15 (8.8)	22 (19.8)	37 (13.12)
		December	17 (9.9)	31 (27.9)	48 (17.02)
	2019	January	29 (17.3)	16 (8.6)	45 (12.75)
		February	16 (9.5)	13 (7)	29 (8.22)
		March	15 (8.9)	29 (15.7)	44 (12.46)
		April	12 (7.1)	7 (3.8)	19 (5.38)
		May	13 (7.7)	21 (11.4)	34 (9.63)
		June	9 (5.4)	20 (10.8)	29 (8.22)
		July	8 (4.8)	18 (9.7)	26 (7.37)
		August	9 (5.4)	14 (7.6)	23 (6.52)
		September	11 (6.5)	9 (4.9)	20 (5.67)
		October	10 (6)	13 (7)	23 (6.52)
		November	23 (13.7)	10 (5.4)	33 (9.35)
		December	13 (7.7)	15 (8.1)	28 (7.93)
	2020	January	27 (10.8)	12 (6.9)	39 (9.2)
		February	12 (4.8)	14 (8.1)	26 (6.13)
PANDEMIC PERIOD	2020	March	14 (5.6)	7 (4)	21 (4.95)
		April	8 (3.2)	8 (4.6)	16 (3.77)
		May	14 (5.6)	10 (5.8)	24 (5.66)
		June	23 (9.2)	11 (6.4)	34 (8.02)
		July	13 (5.2)	9 (5.2)	22 (5.19)
		August	17 (6.8)	18 (10.4)	35 (8.25)
		September	14 (5.6)	18 (10.4)	32 (7.55)
		October	19 (7.6)	23 (13.3)	42 (9.91)
		November	31 (12.4)	17 (9.8)	48 (11.32)
		December	59 (23.5)	26 (15)	85 (20.05)
	2021	January	16 (7.7)	14 (6.9)	30 (7.32)
		February	16 (7.7)	11 (5.4)	27 (6.59)
		March	31 (15)	21 (10.3)	52 (12.68)
		April	20 (9.7)	25 (12.3)	45 (10.98)
		May	21 (10.1)	14 (6.9)	35 (8.54)
		June	5 (2.4)	10 (4.9)	15 (3.66)
		July	8 (3.9)	24 (11.8)	32 (7.8)
		August	16 (7.7)	21 (10.3)	37 (9.02)
		September	18 (8.7)	18 (8.9)	36 (8.78)
		October	23 (11.1)	23 (11.3)	46 (11.22)
		November	18 (8.7)	11 (5.4)	29 (7.07)
		December	15 (7.2)	11 (5.4)	26 (6.34)
	2022	January	26 (36.1)	14 (31.1)	40 (34.19)
		February	33 (45.8)	24 (53.3)	57 (48.72)
		March	13 (18.1)	7 (15.6)	20 (17.09)

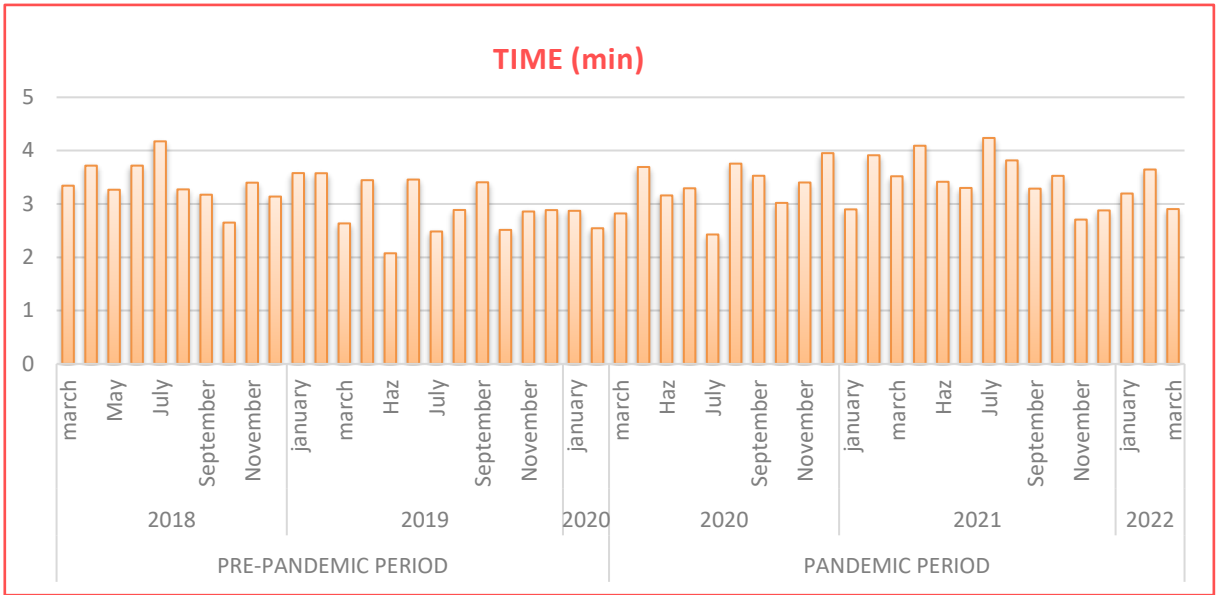

Figure 2: The distribution of the time to reach the emergency before the pandemic and during the pandemic period of the code blue team, according to months

The comparison of the outcomes of the code blue calls is shown in Table 4. The frequency of intensive care unit admission and patient deaths in both periods and in total was similar between groups (P = 0.298).

While the response times to 345 patients in Group I were similar to each other (P = 0.270), the response times of 837 patients in Group II differed based on their status (P < 0.001). In Group I, the mean reaction time given to < 0.001). In Group I, the mean reaction time given to patients who were followed in a ward (2.6 ± 1.49 min) was considerably lower than the response time given to While the response times to 345 patients in Group I were similar to each other (P = 0.270), the response times of 837 patients in Group II differed based on their status (P < 0.001). In Group I, the mean reaction time given to patients who were followed in a ward (2.6 ± 1.49 min) was considerably lower than the response time given to patients who were admitted to the critical care unit and those who died (3.44 ± 1.76 vs 3.80 ± 1.81 min, respectively). Similar variations were identified across all cases (Table 5).

Table 3: Distribution of true code blue calls according to time of day

Working Hours	Group I	Group II	Total	P
Duty working hours (08-16)	137 (39.6)	194 (39.5)	331 (39.5)	0.980
Off duty working hours				
(16-08)	209 (60.4)	297 (60.5)	506 (60.5)	
Day & Night				
00-02	16 (4.6)	22 (4.5)	38 (4.5)	0.677
02-04	28 (8.1)	43 (8.8)	71 (8.5)	
04-06	27 (7.8)	50 (10.2)	77 (9.2)	
06-08	27 (7.8)	44 (9.0)	71 (8.5)	
08-10	39 (11.3)	44 (9.0)	83 (9.9)	
10-12	33 (9.5)	57 (11.6)	90 (10.8)	
12-14	29 (8.4)	52 (10.6)	81 (9.7)	
14-16	36 (10.4)	41 (8.4)	77 (9.2)	
16-18	34 (9.8)	35 (7.1)	69 (8.2)	
18-20	36 (10.4)	49 (10.0)	85 (10.2)	
20-24	41 (11.8)	54 (11.0)	95 (11.4)	

P values calculated using Chi-Square test.

4. Discussion

Code blue is an emergency management tool that enables the responsible team to respond promptly to patients in need of immediate medical care. Delayed intervention can lead to an increase in mortality and morbidity. All guidelines especially highlight the safety of the CBT during the intervention of a patient with a

Table 4: Outcomes of code blue calls

Outcome	Group I	Group II	Total	P
Intensive care	130 (37.6)	189 (38.5)	319 (38.0)	0.298
Ward	43 (12.4)	45 (9.0)	88 (10.5)	
Death	172 (50.0)	258 (52.5)	430 (51.5)	
Total	345 (100)	492 (100)	837 (100)	

P values calculated using Chi-square test; Data presented as n (%)

Table 5: Comparison of code blue response times vs. outcomes

Outcomes		n	Code Blue Response Times Mean ± SD (min)	P
Group I	Intensive Care	130	3.33 ± 1.55	
	Ward	43	2.97 ± 1.16	0.270
	Death	172	3.10 ± 1.48	
	Total	345	3.17 ± 1.47	
Group II	Intensive Care	189	3.44 ± 1.76	**<0.001**
	Ward	45	2.60 ± 1.49 ^{A}	
	Death	258	3.80 ± 1.81 ^{B}	
	Total	492	3.55 ± 1.79	
Total	Intensive Care	319	3.39 ± 1.67 ^{B}	**0.005**
	Ward	88	2.78 ± 1.35 ^{A}	
	Death	430	3.52 ± 1.72 ^{B}	
	Total	837	3.39 ± 1.68	

P values calculated using ANOVA. Letters shown with superscripts (^{A,B}) in the columns express statistical significance (P < 0.05) according to the Tukey test.

COVID-19 diagnosis.[7,8] During the COVID-19 epidemic, many patients who required critical care unit monitoring were instead monitored in the wards, resulting in a significant increase in the workload of CBTs. The team's use of protective gear necessitated unwelcome but unavoidable delays in initiating patient care.[9]

-In our study, we aimed to compare code blue applications before and during the pandemic in terms of patient characteristics, application duration, and application outcomes, and to evaluate the results by highlighting the differences. We observed that patients were comparable in terms of age and gender, with male patients outnumbering female patients in both time periods.

According to literature published prior to the pandemic, the number of male patients receiving CPR was higher (56-70% vs. 30-43%). Men have a higher incidence of coronary issues such as myocardial infarction and angina pectoris, so women have a lower rate of CPA.[10,11] Studies published during the pandemic have also reported that men have a greater rate of CPA that is attributed to the high rate of male gender amongst COVID-19 patients and its association with comorbid diseases.[12,13] In both groups of our study, similar to literature, the number of male patients was greater than the number of female patients.

Several studies have reported a majority of code blue calls being made after working hours. Pattnaik et al., Arkan et al. and Baytar et al. reported the off working hours code blue rate to be 72.6%, 62.2% and 69.0% respectively.[2,14,15] Baytar et al. reported that the code blue outcomes outside of business hours were less successful compared to those during working hours.[16] However, when we evaluated the code blue outcomes for those made in vs. out of working hours and also when we broke down the daytime into 2-hour time intervals, we found no significant difference.

It is well recognized that prompt intervention in patients with CPA and early defibrillation improves survival and discharge rates. For effective CPR, CBT must arrive at the call location within 3 min. This is critical for CPA patients since delayed management increases mortality and the likelihood of neurologic sequelae.[16] Data from the pre-pandemic period reports the average time to reach the patient in code blue applications is between 1.3 and 5.7 min.[17,18] In studies from our country, the response time of CBTs has been reported as 2.2 min by Özgür et al., 1.97 min by Arikan et al., 3.56 min by Gurmen et al., 3.45 min by Esen et al. and 4.31 min by Bayramoglu et al., respectively.[19-23] The average response time during the pre-pandemic period in our study was 3.15 min, similar to the aforementioned literature findings.

During the COVID-19 pandemic, the most important additional recommendations made to resuscitation practices, aimed at reducing the risk of cross-infection by the practitioner, was the wearing of personal protective equipment, which resulted in a delay in commencing CPR. Tong et al. found that during the

pandemic, the median arrival time of resuscitation teams increased while the rate of first responder CPR, defined as the immediate commencement of CPR within the first one minute after cardiac arrest, declined.[24] In an investigation of patients with and without COVID-19, Delen et al. reported that the code blue crew took longer to reach patients with COVID-19, and this time was delayed by approximately one minute. The authors underlined that the pandemic has made standard resuscitation procedures challenging, and that it is critical for the rescue crew to wear protective equipment correctly in order to avoid contamination and to begin assistance as soon as possible during this period when code blue is operational.[25] In our study, we observed that the length was prolonged (3.15 min vs. 3.81 min) in the average values of all months when the pre-pandemic period was compared to the pandemic period; despite being no significant difference when each month was analyzed separately.

According to research, in-hospital death rates of COVID-19 diagnosed patients with CPA are high as CPA is caused by a non-shockable rhythm induced by hypoxemia, thus resulting in low success rate of CPR and resumption of spontaneous circulation.[12,13] When outcomes (intensive care admission, ward admission or death) in our study were analyzed in true CBC's, the rate of death and the rate of intensive care or ward admission after spontaneous circulation resumed were similar in both study periods and amongst all patients.

Response times based on outcomes were another parameter examined in our study. It is well established that the code blue crew arriving at a CPA quickly and initiating early intervention boosts the odds of survival, as well as the discharge rates. According to the American Heart Association's guidance, CPA intervention under 2 min significantly increases the rate of survival.[26] We observed that patients who were followed up in the ward after successful resuscitation during the pandemic period had a significantly shorter response time when compared to patients who were admitted to intensive care or those who died.

5. Limitations

Our study consists of data from patients suffering from CPA on the wards and subsequently treated by code blue teams. Code blue calls given from intensive care units are not included in this study, therefore, mortality is not discussed.

The long-term mortality of the CPA patients was not analyzed. Because our hospital was a pandemic hospital during the COVID-19 pandemic, all patients were assumed to be infected with COVID-19.

6. Conclusion

In our study, we found that the success rate of resuscitation for individuals, who were treated promptly, particularly during the pandemic, was greater when compared to before the pandemic. This can be explained by the fact that CPA during the COVID-19 pandemic occurs primarily owing to respiratory causes, and that early management is crucial and very successful in these cases. Although numerous factors affect patient mortality, the timing of CPR intervention is crucial to its early effectiveness.

7. Data availability

The data generated during this study is available from the authors on request.

8. Conflict of interests

The authors declare no conflicts of interest with respect to the authorship and/or publication of this article.

9. Financial Disclosure

All authors declare no financial support, either from internal or industry sources.

10. Declaration

This study was presented as an oral presentation in 56th National Congress of Turkish Society of Anesthesiology and Reanimation, held in Antalya Kaya Palazzo Hotel on 3-6 November 2022.

11. Authors' contribution

Both authors took equal part in the concept, conduction of the study work and manuscript wriring and editing. Both authors have approved the final draft.

12. References

1. 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. DOI: 10.5152/eajem.2017.79664
2. 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 Oct 1;3(Suppl 1):A205. [PubMed] DOİ: 10.1186/2197-425X-3-S1-A205
3. Sağlık kurum ve kuruluşlarında hasta ve çalışan güvenliğinin sağlanması ve korunmasına ilişkin usul ve esaslar hakkında tebliğ. Resmi Gazete, 29 Nisan 2009 sayı: 27214. [FreeFullText]
4. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet. 2020;395(10223):497-506. [PubMed] DOI: 10.1016/S0140-6736(20)30183-5
5. Guo T, Fan Y, Chen M, Wu X, Zhang L, He T, et al. Cardiovascular implications of fatal outcomes of patients with Coronavirus Disease 2019 (COVID-19). JAMA Cardiol. 2020;5(7):811-8. [PubMed] DOI: 10.1001/jamacardio.2020.1017
6. Nolan JP, Monsieurs KG, Bossaert L, Böttiger BW, Greif R, Lott C, et al. European Resuscitation Council COVID-Guideline

Writing Groups. European Resuscitation Council COVID-19 guidelines executive summary. Resuscitation. 2020;153:45-55. [PubMed] DOI: 10.1016/j.resuscitation.2020.06.001

7. COVID-19. Practical Guidance for Implementation. Available from: ilcor.org/covid-19
8. COVID-19 hastalarında veya şüpheli durumlarda kardiyopulmoner resüsitasyon (KPR) ve mavi kod ekibi için dikkat edilecek konular. Available from: tard.org.tr/assets/pdf/MAVI-KOD-KPR-COVID-19.pdf
9. Chan PS, Berg RA, Nadkarni VM. Code blue during the COVID-19 pandemic. Circ Cardiovasc Qual Outcomes. 2020;13(5):e006779. [PubMed] DOI: 10.1161/CIRCOUTCOMES.120.006779
10. Andersen LW, Holmberg MJ, Berg KM, Donnino MW, Granfeldt A. In-hospital cardiac arrest: a review. JAMA. 2019;321(12):1200-10. [PubMed] DOI: 10.1001/jama.2019.1696
11. Oğuztürk H, Turtay MG, Tekin YK, Sarıhan E. Acil serviste gerçekleşen kardiyak arrestler ve kardiyopulmoner resüsitasyon deneyimlerimiz. Kafkas J Med Sci. 2011;1(3):114–7. DOI: 10.5505/kjms.2011.08108
12. Shao F, Xu S, Ma X, Xu Z, Lyu J, Ng M, et al. In-hospital cardiac arrest outcomes among patients with COVID-19 pneumonia in Wuhan, China. Resuscitation. 2020;151:18-23. [PubMed] DOI: 10.1016/j.resuscitation.2020.04.005
13. Hayek SS, Brenner SK, Azam TU, Shadid HR, Anderson E, Berlin H, et al. In-hospital cardiac arrest in critically ill patients with covid-19: multicenter cohort study. BMJ. 2020;371:m3513. [PubMed] DOI: 10.1136/bmj.m3513
14. Arıkan M, Ateş A. The evaluation of effectiveness and outcomes of code blue system in a new tertiary care hospital. Int J Clin Res Trials. 2019;4:135. DOI: 10.15344/2456-8007/2019/135
15. Baytar MS, Baytar Ç. Mavi kod, gerçekten mavi mi? Van Tıp Derg. 2022;29(2):212-6. DOI: 10.5505/vtd.2022.67934.
16. 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 Suppl 3):S640-56. [PubMed] DOI: 10.1161/CIRCULATIONAHA.110.970889
17. Peters R, Boyde M. Improving survival after in-hospital cardiac arrest: the Australian experience. Am J Crit Care. 2007;16(3):240-6;quiz 247. [PubMed]
18. Kinney KG, Boyd SY, Simpson DE. Guidelines for appropriate in-hospital emergency team time management: the Brooke Army Medical Center approach. Resuscitation. 2004;60(1):33-8. [PubMed] DOI: 10.1016/S0300-9572(03)00259-4.
19. Özgür Y, Albayrak MD. Göğüs Hastalıkları ve Göğüs Cerrahisi Eğitim ve Araştırma Hastanesinde mavi kod uygulamasının sonuçları. DEU Tıp Derg. 2020;34(1): 35-42. [FreeFullText] DOI: 10.5505/deutfd.2020.97059
20. Arıkan M. Yeni bir eğitim hastanesinde mavi kod sisteminin etkinliği ve sonuçlarının değerlendirilmesi. Gaziosmanpaşa Üniversitesi Tıp Fakültesi Dergisi. 2019;11(2):105-112. [PubMed]
21. Gürmen ES, Demir B. Bir üniversite hastanesindeki mavi kod çağrı sisteminin uygunluğunun ve sonlanımının incelenmesi. Van Tıp Derg. 2019;26(3):353-7. DOI: 10.5505/vtd.2019.57355
22. Esen O, Esen HK, Öncül S, Gaygusuz EA, Yılmaz E, Bayram E. Eğitim ve araştırma hastanesinde mavi kod uygulaması ve sonuçlarının değerlendirilmesi. J Kartal TR. 2016;27(1):57-61. [Free Full Text]
23. Bayramoglu 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. [PubMed] DOI: 10.5152/eajm.2013.34
24. Tong SK, Ling L, Zhang JZ, Yap FHY, Law KL, Joynt GM. Effect of the COVID-19 pandemic on cardiac arrest resuscitation practices and outcomes in non-COVID-19 patients. J Intensive Care. 2021;9(1):55. [PubMed] DOI: 10.1186/s40560-021-00570-8
25. Delen LA, Disli ZK. Evaluation of Code Blue activations in Covid 19 Patients and non-COVID-19 patients: A retrospective research review. Medicine Science. 2022;11(1):195-8. DOI: 10.5455/medscience.2021.09.291
26. Panchal AR, Bartos JA, Cabañas JG, Donnino MW, Drennan IR, Hirsch KG, et al. Part 3: Adult basic and advanced life support: 2020 American Heart Association Guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. Circulation 2020 Oct 20;142(16_suppl_2):S366-S468. [PubMed] DOI: 10.1161/CIR.0000000000000916

