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Evaluation of Code Blue activations in Covid 19 Patients and non-COVID-19 patients: A retrospective research review

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Abstract

We aimed to contribute to increase the efficiency of the Cardiopulmonary Resusitation (CPR) interventions by comparing the code blue applications activated for patients with and without COVID 19 during the pandemic process. The code blue registration forms who were diagnosed with and without COVID-19 and underwent resuscitation, between March 15-November 30, 2020 were examined retrospectively through the hospital information processing system. Demographic data, time of code blue activation, COVID-19 status, call accuracy, initial heart rhythm, respiratory arrest, survival in the first 24 hours, 30-day survival, discharge, time to reach unit. CPR durations were recorded. 79% of patients with code blue were covid-19. İnitial asystolic rhythm was present 16.7%, VF arrest was present in 34.8% and respiratory arrest was present in 71.7% patients and 53.6% of the patients died in the first 24 hours. The average time the team reaches the unit was aproximately 3 minutes, and the mean CPR duration was apoximately 30 minute. The rate initial asystolic rhythm was found higher in COVID- patients . The rate being declared exitus was higher in COVID-19 patients. The time to reach the place of activation and the duration of CPR were found higher in COVID-19 patients. The time to reach the place was found to be delayed for about 1 minute in our study. To develop strategies for minimizing the time between wearing the protective equipment properly and the response to the blue code without delay should be our first goal for the success of resuscitation.

Keywords: COVID-19, non-COVID-19, Code-blue, Cardiopulmonary resuscitation, In-hospital cardiac arrest

Introduction

In Covid-19 patients, the development of hypoxemic respiratory failure, myocardial damage, ventricular arrhythmias and shock due to acute respiratory distress syndrome (ARDS), makes the course of the disease more severe and makes patients vulnerable to the development of cardiac arrest [1]–[5]. In a study evaluating 136 patients, in Wuhan, it was emphasized that the risk of cardiopulmonary arrest was 20% in COVID-19 patients [6]. Procedures in cardiopulmonary arrest interventions for COVID-19 patients with high risk were published in guidelines [7]. Since cardiopulmonary resuscitation (CPR) interventions in COVID 19 patients include procedures that cause aerosolization, protective code blue algorithms have been formulated for healthcare providers who perform these procedures [8]. However, these algorithms include measures that may cause delays in the interventions in critical COVID -19 patients. The aim of this study is to increase the efficiency of the code blue activation during the pandemic process by making comparative analysis of the code blue interventions for the critical COVID -19 patients and those who were hospitalized for reasons other than COVID-19.

Materials and Methods

We started our study after getting the protocol code 2021/16 from Malatya Inönü University. In this study, the code blue registration forms and patient files of the patients who were diagnosed with and without COVID-19 and underwent resuscitation, in Malatya Training and Research Hospital between March 15, 2020 and November 30, 2020 were examined retrospectively through the hospital information processing system. Patients under 18 years of age and trauma patients were excluded from the study.

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Demographic data of the patients, time of code blue activation, COVID-19 status, call accuracy, initial heart rhythm, respiratory arrest, survival in the first 24 hours, 30-day survival, discharge, time to reach unit (min), CPR duration (min) were recorded by comparing patients with and without COVIDs.

Statistical analysis

The data were evaluated by SPSS 22 package program (Statistical Package for Social Sciences; SPSS Inc., Chicago, IL). Descriptive categorical data were expressed as numbers and percentages and continuous data were expressed as mean ± standard deviation, median, and interquartile range (25-75 percentile values). In the comparisons of categorical variables between groups Chi-square analysis (Pearson Chi-square) was used. The Kolmogorov-Smirnov Test was used for the evaluation of the normal distribution of continuous variables. The Mann-Whitney U test was used for the comparison of variables that did not conform to normal distribution between the two groups. A value of $p < 0.05$ was accepted as statistically significant.

In our study, compliance with the control list used with the equator guide has been ensured.

Results

In this study, the files of 138 patients on whom a blue code was activated were examined; 88 of the patients (63.8%) were male and the mean age was 70.8±16.8 (min=20-max=102). We detected that 56 (40.6%) of the code blues were activated within shift and 135 (97.8%) of the code blues were true activations. We found that, 109 (79%) of the patients on whom code blue was activated were COVID-19 patients. We detected that, initial asystolic rhythm was present in 23 (16.7%), VF arrest was present in 48 (34.8%), and respiratory arrest was present in 99 (71.7%) patients and 74 (53.6%) of the patients died in the first 24 hours. The average time the team reaches the unit where the code blue is activated was 2.6±.8 (min=1-max=5), the median time was 3 minutes, and the mean CPR duration was 32.3±12.3 (min=5-max=45). The median duration was calculated as 30 minutes (Table 1).

The rate of code blue activation during the shift was found to be significantly lower in COVID-19 patients compared to non-COVID-19 patients (p=0.026). The rate initial asystolic rhythm was found to be significantly higher in COVID- patients compared to non- COVID- 19 patients (p=0.046). The rate being declared exitus was significantly higher in COVID-19 patients compared to non-COVID-19 patients (p<0.001). The time to reach the place of activation (p<0.001) and the duration of CPR p=0.001) were found to be significantly higher in COVID-19 patients. No significant difference was found between the COVID-19 patients and nonCOVID-19 patients in terms of gender, age, call accuracy, rate of initial rhythm of VF arrest, and rate of initial rhythm of respiratory arrest (p>0.05) (Table 1).

The rate of being declared exitus was found to be significantly higher in patients on whom the code blue activation was called in shift (p=0.005). The rate of being declared exitus was significantly higher in patients present with an initial rhythm of asystole compared to those without asystole (p=0.009). The rate of being declared exitus was significantly higher in those with an initial rhythm of VF arrest compared to those without VF arrest (p=0.009). The rate of being declared exitus was significantly higher in those with an initial rhythm of respiratory arrest compared to those without respiratory arrest (p=0.002). The mean age (p=0.01), time to reach the place of activation (p=0.009) and duration of CPR (p<0.001) were found to be significantly higher in patients who were declared exitus (Table 2).

The distribution of patients who died within 30 days, who were discharged, and who were hospitalized is shown in Table 3.

Table 1. Comparison of COVID-19 patients and non-COVID 19 patients according to parameters used in the analyses

		COVID patient		Non-Covid patient		Total		p
		number	%	number	%	number	%	
Gender	Male	73	67.0	15	51.7	88	63.8	0.129*
	Female	36	33.0	14	48.3	50	36.2	
Age. Mean ± SD		72.1±16.3		65.9±17.9		70.8±16.8		0.081**
Code blue activation time	Working hours	39	35.8	17	58.6	56	40.6	0.026*
	Non-Working hours	70	64.2	12	41.4	82	59.4	
Call accuracy is correct	true	106	97.2	29	100.0	135	97.8	0.999*
	false	3	2.8	0	.0	3	2.2	
Initial rhythm asystoli	yes	22	20.2	1	3.4	23	16.7	0.046*
	No	87	79.8	28	96.6	115	83.3	
Initial rhythm VF	yes	38	34.9	10	34.5	48	34.8	0.970*
	No	71	65.1	19	65.5	90	65.2	
Respiratory Arrest	yes	76	69.7	23	79.3	99	71.7	0.308*
	No	33	30.3	6	20.7	39	28.3	
Exitus status (within 24 hours)	yes	68	62.4	6	20.7	74	53.6	<0.001*
	No	41	37.6	23	79.3	64	46.4	
Time to reach the activation place (min). mean± SD		2.8±0.8		2.1±0.7		2.6±0.8		<0.001**
Duration of CPR (min). mean± SD		34.2±12.3		25.0±9.8		32.3±12.3		0.001**

* Kikare analysis, ** Mann Whitney U test was performed Column percentage has been used

Table 2. Comparison of COVID-19 patients and non-COVID 19 patients according to parameters used in the analyses

		Exitus Status				P
		Yes		No		
		Number	%	Number	%	
	Male	46	52.3	42	47.7	
	Female	28	56.0	22	44.0	
Age, Mean±SD		74.5±14.0		66.5±18.7		0.01**
Code blue activation time	Shift	22	39.3	34	60.7	0.005*
	After shift	52	63.4	30	36.6	
Whether the activation was true	True	72	53.3	63	46.7	0.999*
	False	2	66.7	1	33.3	
Initial rhythm asystoli	Yes	18	78.3	5	21.7	0.009*
	No	56	48.7	59	51.3	
Initial rhythm VF	Yes	33	68.8	15	31.3	0.009*
	No	41	45.6	49	54.4	
respiratory arrest	Yes	45	45.5	54	54.5	0.002*
	No	29	74.4	10	25.6	
Time to reach the activation place (min), Mean±SD		2.8±0.8		2.4±0.8		0.009**
Duration of CPR (min), Mean±SD		41.7±7.3		21.4±6.8		<0.001**

*chi-square analysis, **Mann Whitney U test, IQR: İnterquartile Range Column percentage was used

Table 3. Evaluation of hospital stay and exitus status of the patients

	COVID-19 patient	Non-COVID-19 patient
Total EX in 30 days	85	21
Within 24 hours (the number of EX)	68	6
Discharge at 30 days (N)	15	5
24 hours-7 days (the number of EX)	7	8
Staying longer than 30 days (N)	9	3
Exitus between 7 and 14 days	5	5
Exitus between 14 and 21 days	4	1
Exitus between 14 and 21 days	1	1

Discussion

Code Blue is an emergency management tool that enables the responsible team to respond to patients in need of emergency medical intervention as soon as possible. If the respond to the activation code is delayed, it can lead to the development of unwanted mortality and morbidity. The safety of the rescue team has been noted in all guides describing the blue code approach to patient with COVID-19 [9]. Delays in respond have occurred in respond code blue calls, due to the fact that the patients who need to be followed in intensive care units have been followed in general wards due to increased patient load and the protective measures that should be followed by the rescue team are too time consuming in COVID 19 cases. However the protection of rescue team is crucial during the pandemic period.

The inclusion of non-COVID-19 patients along with severe COVID-19 patients for the comparison of Code blue activation parameters was an original aspect of our study. There was no difference between the patients who were hospitalized without COVID- 19, in terms of gender. As in all studies, male patients were more common in covid-19 arrests [6, 10, 11]. Mean age was similar to the literature. We found that 79% of the blue code activations were called for COVID 19 patients, the difference was statistically significant when compared to the non-COVID-19 patients. Similar to other studies, we detected that the majority of patients, for whom the blue code was activated, were present with respiratory arrest [6, 10, 11]. Approximately half of the patients died in the first 24 hours. The rate of patients who died was significantly higher in the COVID 19 patients compared to the non-COVID-19 patients. The time to reach the place where the blue code was activated was found to be delayed for about 1 minute, in severe COVID-19 patients. The importance of the use of personal protective equipment in order to minimize the risk of contamination for the intervention team was emphasized in all of the resuscitation guidelines. It is thought that one minute delay is within normal limits. In addition, the duration of CPR was found to be significantly higher in critically ill COVID 19 patients. Since the chance of survival is higher COVID-19 patients with no additional disease, the prolonged duration of CPR periods can be considered as an indicator of how precisely healthcare professionals work.

In a study conducted in Italy, it was stated that the frequency of out-of-hospital cardiac arrest increased by 58% in 2020 compared to the previous year, and the time to reach the hospital was prolonged approximately 3 minutes [12]. The rate of resuscitation at the scene by witnesses decreased by 16% and the frequency of out-of-hospital mortality was found to be increased by 15%. The researchers emphasized that the pandemic process has changed the health system. As we would like to emphasize in our study, both reservations and the wearing of protective equipment by the rescuer can cause loss of time in Covid-19 arrests.

In a study evaluating 31 patients with Covid-19 who developed cardiac arrest in Manhattan hospital. The average resuscitation time was recorded to be 14 minutes [11]. In the study of Murat et al., 180 code-blue warning systems were examined and the time to reach non-covid patients was found to be approximately 3 minutes [13]. In our study, the average time the team reaches the unit where the code blue is activated was 3 minutes, and the mean CPR duration was calculated as 30 minutes. The duration between the time the blue code was activated and the time patients were declared exitus was recorded to be 2.8 hours [11]. In this study all patients died and none were discharged. In our study, 31 patients survived in 30 days.

Contrary to many studies, the first arrest rhythm was determined as VF in our case. We attribute this to the early giving of the blue code alarm [6,10, 11].

In a study conducted in Wuhan, 136 patients out of 761 patients with severe COVID 19 were evaluated and the etiology of arrest was found mostly to be respiratory, as in our study. The most common symptom was shortness of breath. In 13.2% of the patients who underwent CPR, spontaneous breathing was provided, 2.9% of the patients survived at least 30 days. They was found that the place of cardiac arrest and the baseline rhythm affect the results. In the 40 day evaluation of patients with severe COVID -19 pneumonia, the rate of mortality was found to be 19,3% [6].

Conclusion

In conclusion, the time to reach the place where the blue code was activated was found to be delayed for about 1 minute. The COVID 19 pandemic we experienced that made the routine procedure of resuscitation more difficult. It should be noted that both wearing protective equipment properly in order to minimize the contamination and initiating the intervention without delay are crucial for the rescue team, in critical COVID 19 patients on whom blue code was activated. In our hospital, shift work was organized in clinics and it was aimed to prevent possible delays by keeping personal protective equipment ready for use. To develop strategies for minimizing the time between wearing the protective equipment properly and the response to the blue code without delay should be our first goal for the success of resuscitation.

Conflict of interests
The authors declare that they have no competing interests.

Financial Disclosure
All authors declare no financial support.

Ethical approval
We started our study after getting the protocol code 2021/16 from Malatya Inönü University.

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