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RESUSCITATION IN COVID-19 PANDEMIC

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ABSTRACT
Cardiac arrest is one of the leading causes of death worldwide. The coronavirus disease 2019 (COVID-19) pandemic has impacted both the epidemiology and outcome of cardiac arrests, further reducing survival after cardiac arrest. Resuscitation of patients with COVID-19 has become a complex problem due to several issues, including the need for personal protective equipment, prevention of viral transmission, ventilator management challenges, and difficulties in performing effective and high-quality cardiopulmonary resuscitation.

In this review, we aimed to assess the evidence of the impact of COVID-19 on out-of-hospital cardiac arrest and in-hospital cardiac arrest during the pandemic.

Keywords: pandemic, resuscitation, CPR, mortality, in-hospital cardiac arrest, out-of-hospital cardiac arrest

INTRODUCTION
Cardiac arrest is one of the leading causes of death worldwide[1]. The coronavirus disease 2019 (COVID-19) pandemic affected both the epidemiology and outcomes of cardiac arrest and also increased the numbers of cardiac arrests.

The World Health Organization (WHO) lists chest compressions and airway interventions as procedures that produce aerosols. Basic and advanced life support guidelines published by the WHO and in the field of resuscitation provided a modified algorithm for COVID-19 patients. The Resuscitation Council in Turkey published these algorithms in Turkish[2].

In the pandemic period, as a result of studies reporting outcomes in the field of resuscitation being published in the literature, data about demographic features and mortality of cardiac arrest cases were obtained. In addition to these results, scientific data show the differences that were present during cardiopulmonary resuscitation (CPR) practice, especially.

How has the incidence of cardiac arrest changed in the pandemic?
To answer this question, it is necessary to firstly know the mortality and survival spectrum in out-of-hospital and in-hospital resuscitation before the pandemic. Before the pandemic, out-of-hospital cardiac arrest (OHCA) cases had return of spontaneous circulation (ROSC) rate of 17.6% and survival rate of 26.9% [3,4], while during the pandemic the ROSC rate was 17% and survival rate reduced to 17.9%. The in-hospital cardiac arrest (IHCA) study results found ROSC and mortality rates during resuscitation were negatively impacted during the pandemic, similar to OHCA. Before the pandemic, for IHCA, the ROSC rate was 51-70% and survival rate was 13-26.3% [4,5], while during the pandemic the ROSC rate was 13.2% and it is notable that the survival rate clearly reduced to 0-12%.

Out-of-hospital cardiac arrests
In the United States of America (USA), a study including 19,303 adult patients compared OHCA cases for the same periods in 2019 (16 March – 30 April 2019) and 2020 (16 March – 30 April 2020), in other words before and during the pandemic. In the study, there was a significant increase in OHCA incidence during the COVID-19 pandemic compared to the period before the pandemic [6]. Additionally, the ROSC and survival until discharge from hospital rates were identified to significantly fall during the pandemic (23 vs. 29.8% and 6.6 vs. 9.8%, respectively).

A systematic review including a total of 10 studies and 35,379 OHCA cases reported similar results [2]. In this review, the first 10 months of the pandemic were compared to the pre-pandemic period. Data from a total of 5 countries in different regions of the world were investigated including Australia, France, Italy, Spain and the USA[3]. In the pre-pandemic period, the number of cardiac arrest cases was 4018, while this number rose to 8822 during the pandemic and the cardiac arrest incidence increased by 119.6% during the pandemic, rising two-fold[3]. The mortality rate was 62% before the pandemic and rose to 84.9% during the pandemic. The same study found the following results when the OHCA characteristics were compared to the pre-pandemic period. During the pandemic, cardiac arrests occurred mostly at home, the number of cardiac arrests due to traumatic causes was lower, the use of supraglottic airway devices was greater, the duration for the ambulance to reach the incident site was longer, witnesses began CPR and used automatic external defibrillators (AED) less, and rhythms administered shock were less. In both studies, increases were reported in two features associated with poor outcomes

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during the pandemic; the number of arrests due to non-shockable rhythms and occurring at home. The ROSC rate and survival until hospital discharge rates were reported to be lower[3,6]. However, in spite of the increase in cardiac arrests occurring at home, the rate of CPR in witnessed arrests did not change [3,6]. This probably reflects the higher number of family members remaining at home during quarantine.

Another potential cause for the increases in OHCA rates and worse outcomes during the COVID-19 pandemic may be the restriction in access to or delay in emergency care services. Several studies reporting outcomes in the pandemic period stated that there were longer response intervals due to the increasing workload in emergency medical services (EMS)[3]. Contrary to this, hospital admissions due to acute coronary syndrome (ACS) and heart failure reduced during pandemic waves in both Europe and the USA[7]. The reason for this is probably that patients avoided hospitals due to fear of being infected with COVID-19 and delayed attending routine check-ups and the reduction in routine cardiac care with the 'stay-at-home' strategy. This may have caused an increase in the severity of ACS and heart failure and hence an increase in the probability of cardiac arrest[7]. Though patient follow-up and care was performed with the telemedicine model, the telemedicine model has weak aspects, especially for management of cardiac patients. When the negative cardiac impacts of the COVID-19 virus are added, outcomes may have been further negatively affected. Reasons like increased intensity in emergency services and delays in beginning CPR due to putting on personal protective equipment (PPE) comprise other components that may cause increased mortality. The reduction in the number of trauma-induced OHCA is clearly associated with the stay-at-home strategy.

In-hospital cardiac arrests

When studies reporting in-hospital cardiac arrest outcomes are investigated, mortality rates increased. Edward et al. reported that during the pandemic, COVID-19 reduced both IHCA and ROSC rates and increased mortality in the United Kingdom[8]. In the study, they compared the IHCA before the pandemic to during the pandemic period. During the pandemic, they identified higher IHCA rate and lower ROSC and survival rates. These negative outcomes were revealed more clearly in hospitals with excess COVID burden, especially. In this study, hospitals were divided into three groups according to COVID burden as low, medium and high and each outcome was compared in the 3 groups. IHCA outcomes were assessed per 10,000 patient admissions. When the same period (March, April, May) in 2016-2019 before the pandemic was compared to the same period in 2020, the number of cardiac arrests was identified to be higher[8]. When hospitals were compared according to COVID-19 burden, hospitals with low COVID-19 burden did not have an increase in number of arrests per 10,000 admissions during the pandemic, while hospitals with medium and high COVID-19 burden were identified to have higher numbers[8]. When the features of cardiac arrest in this study are investigated, it was reported that the number of arrests observed in the emergency service (9% vs. 12%) and intensive care unit increased during the pandemic compared to before the pandemic (18.7% vs. 20.3%). During the pandemic, shockable rhythms were slightly increased though not statistically significant as first cardiac arrest rhythm. While the pre-pandemic mortality rate was 47.5%, it was concluded to rise to 52.9% during the pandemic. The survival rate after discharge from hospital was reduced during the pandemic period[8].

In most resuscitation studies during the pandemic, patient outcomes for cardiac arrest are presented with demographic features by generally investigating cardiac arrests occurring during this period, independent of whether the patients are COVID-19 positive or not. However, the number of studies analyzing outcomes by classifying patients according to being COVID-19 positive is few. Results of another study reporting from the New York region in the USA is important, it presents an analysis of cardiac arrest outcomes according to patients being COVID-19 positive or negative. In this study, the reported survival rate was 1.7% [9].

A study researching Swedish cardiac arrest records included 1946 OHCA cases and 1080 IHCA cases. During the pandemic, 88 OHCA (10%) and 72 IHCA (16%) cases were identified to have COVID-19 infection. It was stated that mortality significantly increased in OHCA and IHCA cases with continuing COVID-19 infection. Among OHCA cases with COVID-19 infection, the 30-day mortality rate was 3.4 times increased and higher for men. For IHCA cases with COVID-19 infection, the 30-day mortality rates was 2.27 times increased and higher for women[10].

A meta-analysis reporting outcomes for IHCA cases with COVID-19 diagnosis is important in terms of presenting the resuscitation characteristics of COVID-19 positive patients during the pandemic. This meta-analysis investigated a total of 10 studies, including 8 from the USA, 1 from Sweden, and 1 from China, and reported the 30-day mortality rate was 90%. Without regard to whether arrest occurred in the intensive care unit or in the ward, mortality rates were similarly high. Of arrests, 64.9% were in the intensive care unit and 35.1% were outside of the intensive care. The first arrest rhythm was shockable at rates of 89%, while the ROSC rate was 32.9%. However, only 4 studies reported the neurological status of ROSC patients. Patients with Cerebral Performance Category (CPC) score of 1 or 2 had 30-day mortality rate of 6.3% [11]. The authors attracted attention to the following main headings with this meta-analysis; the study cohorts were very heterogeneous, there was little data related to COVID-19 patient outcomes apart from the USA, and future studies need to compare IHCA outcomes in groups with and without COVID-19. International guidelines related to cardiac arrest management in COVID-19 recommend limiting the number of team members during first intervention, not beginning chest compressions until PPE is worn to prevent aerosol transmission in air, and stopping

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chest compressions during potentially aerosolizing maneuvers like tracheal intubation[12]. It was recommended to insert a double viral filter during balloon-mask ventilation and to stop continuous chest compressions until tracheal intubation. Intubation should be performed by an experienced practitioner and if available, video laryngoscopy should be used to minimize the aerosolization risk. All these recommendations aim to reduce the risk for life-savers; however, they may reduce the efficacy of CPR. Even if the airway of a COVID-19 patient with mechanical ventilation in the intensive care unit is reliable, providing chest compressions may be delayed due to the need to put on PPE. Additionally, using the prone position, a part of COVID-19 treatment, may make CPR difficult due to the difficulties of the position. Though specific scores have not been developed to predict resuscitation outcomes in COVID-19 patients, assessing risk factors for negative outcomes like age[10], degree of organ dysfunction and continuing treatment may provide a guide.

The COVID-19 pandemic and need to wear PPE affected CPR performance and the duration to beginning CPR in cardiac arrest may have lengthened, as shown for patients with out-of-hospital cardiac arrest. The final outcome of these special situations may have affected the chances of survival. However, the number of scientific studies performed related to the duration to start CPR is very few. There is no data related to the duration to start chest compressions in cardiac arrest.

Another topic is about the efficacy of CPR performance performed with PPE. There is no data related to this topic in the studies available in the literature. However, mannequin studies underlined that fatigue began after 1 minute in implementors during CPR when wearing PPE and that the standard recommendation to change implementors of CPR every 2 minutes may be reduced to 1 minute for CPR performed in PPE [13].

Chan et al.[14] reported that during the first COVID-19 wave in the USA, the survival rates after discharge were lower for patients who underwent CPR. Study results identified that the cardiopulmonary resuscitation duration was shorter and there were more frequent delays in defibrillation implementation. Even for patients without COVID-19 infection, survival rates until discharge after in-hospital cardiac arrest fell and the COVID-19 pandemic was emphasized to have early negative impact on in-hospital resuscitation.

A study by Aldabagh et al.[15] identified the most common risk factors affecting cardiac arrest outcomes in COVID-19 patients admitted for treatment. In this study the mortality rate was reported to be 1.7% and the authors interpreted the associated outcomes as follows. The first arrest shockable rhythm rate was 7%, while the non-shockable rhythm rate was 17%, so low survival rate may be linked to the lack of shockable rhythms during cardiac arrest. Many studies found that patients with shockable rhythm during cardiac arrest have nearly 50% survival rates until discharge from hospital. Contrary to this, the probability of survival with initial non-shockable rhythm was two to three times lower[16]. Another risk factor increasing mortality was increased age. In this study, it was identified that all COVID-19 patients surviving until discharge from hospital were under 65 years of age. Age is widely associated with reduced survival after cardiac arrest, especially for patients above 60 years[17]. Previous studies showed that elderly patients with serious underlying medical conditions are not only at greater risk of COVID-19 infection, but also have higher risk of death related to COVID-19[18]. Higher mean body mass index (BMI) in COVID patients compared to non-COVID-19 patients was reported to contribute to low survival rates. Many studies during the COVID-19 pandemic showed that the most common morbidities affecting survival of COVID-19 patients were hypertension (HT), diabetes mellitus (DM) and coronary artery disease (CAD), while comorbid infection, malignancy, immune suppression and cerebrovascular disease were less common[19]. Diabetes mellitus was associated with reduced return of spontaneous rhythm and 24-hour survival[20]. COVID-19 patients with poor blood control were found to have increased general mortality[21]. In this study, the number of DM patients was higher in the COVID-19 cohort. Studies researching the relationship between race and outcomes after in-hospital cardiac arrest revealed that Black and Hispanic patients had lower neurological healing and survival rates compared to Caucasians[22]. Unfortunately, Black and Hispanics were most affected by COVID-19 infections, and had higher hospital admission and mortality rates[23]. The results of the study reported that the effects of the pandemic on the health system, CPR quality and patient care were among factors associated with reduced survival.

In addition to these features associated with the pandemic, the number of patients in critical status exceeded the capacity of intensive care units in most hospitals during this unique period in New York. Surgeries, general medical floors and corridors became places where COVID-19 patients with critical status were treated[24]. Care before and after cardiac arrest may have been negatively affected due to limited treatment of COVID-19 infection, in addition to a combination of emotional burden on health workers including fear, fatigue and feelings of hopelessness [25].

When scientific data from studies in our country during the pandemic are examined, the mortality rate after resuscitation increased and survival rates reduced as with data from several countries around the world. In the period from 27 March 2020 to 31 May 2022, a total of 800 days, the number of deaths reported on the Republic of Türkiye Ministry of Health website was 98,970.

Studies about psychological disease that may occur due to fear of transmission in code blue teams during the pandemic period are very limited. The results of a survey study researching the effects on depression and anxiety among code blue team members during resuscitation in our country identified that nearly half of code

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blue team members treating COVID-19 patients were at risk of anxiety and nearly two-thirds of them were at risk of depression. Additionally, people with depression or anxiety risk were found to have higher levels of tension related to the job compared to people not at risk. Additionally, anxiety was shown to be higher with female sex, anxiety, depression and concerns related to the job[26].

Another study assessed resuscitation practices during the pandemic with a retrospective analysis of data from patients with code blue calls from March 2020 to September 2021[27]. During this duration, 58 cases had code blue calls and mean age was 54.78±21.7 years. It was identified that pandemic wards were ranked top among units making code blue calls. As a result of CPR given in code blue calls 53% of patients were exitus and 47% had return of spontaneous circulation and were then transferred to intensive care units. In this study [27], in 56.8% of code blue calls the code blue teams reached the site in 0-3 minutes. As the duration for the code blue team to reach all patients was 4:02 minutes, the authors assessed this as failure in terms of the 0-3 minute standard. The authors emphasized that this failure may have been caused by the adaptation process to a new call system begun within the hospital and users attempting different methods to resolve these problems. As a result, they reported that the targeted duration may be achieved successfully with the improvement of the new system over time, popularization of training within the institute and adoption of practices by users over time[27].

In a study comparing two early warning scores for determination of cardiac arrest risk in patients with COVID-19 diagnosis, the international early warning score used to treat patients with worsening status by early recognition before cardiac arrest was modified for the COVID-19 patient population (MEUS). The early warning score specific to COVID-19 patients called CEUS was defined and modified by adding the ≥65 age criterion[28]. The CEUS was identified to detect early worsening of COVID-19 patients with higher accuracy compared to the MEUS. Similarly in patients with comorbid diseases, the authors stated that CEUS increased earlier and more significantly and proposed that the use of CEUS may be beneficial during monitoring of patients with COVID-19 diagnosis in the ward.

The code blue calls were compared before and during the pandemic in Türkiye. A total of 217 code blue calls were included in the study. Of calls, 50% were identified to be made during working hours. The duration for the team to reach the site was 2.3±0.9 minutes. There was no significant difference in this duration before and during the pandemic. Of patients, 47% were administered CPR and 18% were exitus before the pandemic. During the pandemic, 46% of patients had CPR and 27% were exitus and this rate was identified to increase. In terms of call sites, 20% of calls came from the internal disease ward before the pandemic and 17% of calls came from the pandemic wards after the pandemic. During the pandemic, there was an increase in the number of calls and a significant reduction in the number of patients given defibrillation [29].

Another national study is important in terms of reporting the 1-month and 6-month mortality rates before and after the pandemic. Before the pandemic, the ROSC rate was 53.2%, 1-month survival was 27.2% and 6-month survival was 9.5%. After the pandemic these rates were 28.2%, 7.5% and 2.9%, respectively, with a negative change observed [30].

CONCLUSION

The chain of survival represents a range of actions like immediate recognition of cardiac arrest, early initiation of CPR, early defibrillation, early advanced life support and care after early resuscitation. These actions should occur in the most appropriate way to reduce death rates associated with cardiac arrest. Like any chain, the chain of survival is only as strong as the weakest link. A pandemic may disrupt the chain of survival in a variety of ways and impact patient outcomes. Additionally, it was especially difficult to ensure effective emergency intervention during the COVID-19 pandemic. National and international studies show that receiving COVID-19 diagnosis during the pandemic was associated with high risk of death. Those with COVID-19 diagnosis had reduced rates of shockable rhythm, ROSC and discharge from hospital. We believe new studies to be performed in future years, especially with homogeneous patient cohorts, will provide scientific data for the literature by investigating study results encompassing several countries, CPR initiation time and CPR performance with PPE.

REFERENCES

1. Sandroni C., Skrifvars MB., Nolan JP. The impact of COVID-19 on the epidemiology, outcome and management of cardiac arrest. Intensive Care Med 2021;47(5):602-604.
2. https://resusitasyon.org/tr/erc-2021-kilavuz
3. Lim ZJ., Ponnapa Reddy M., Afroz A., Billah B., Shekar K., Subramaniam A. Incidence and outcome of out-of-hospital cardiac arrests in the COVID-19 era: A systematic review and meta-analysis. Resuscitation. 2020;157:248-258.
4. Ippolito M., Catalisano G., Marino C., Fucà R., Giarratano A., Baldi E., Einav S., Cortegiani A. Mortality after in-hospital cardiac arrest in patients with COVID-19: A systematic review and meta-analysis. Resuscitation. 2021 Jul;164:122-129.
5. Wiberg S., Holmberg MJ., Donnino MW., Kjaergaard J., Hassager C., Witten L. et.al. Age-dependent trends in survival after adult in-hospital cardiac arrest. Resuscitation 2020;151:189-196.
6. Chan PS., Girotra S., Tang Y., Al-Araji R., Nallamothu BK., McNally B. Outcomes for out-of-hospital cardiac arrest in the United States during the Coronavirus disease 2019 pandemic. JAMA Cardiol 2020;2:10.
7. Mitrani RD., Goldberger JJ. Cardiac Arrests During the COVID-19 Pandemic: The Perfect Storm. JACC Clin Electrophysiol. 2021;7(1):12-15.

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8. Edwards JM., Nolan JP., Soar J., Smith GB., Reynolds E., Carnall J., et.al. Impact of the COVID-19 pandemic on in-hospital cardiac arrests in the UK. Resuscitation. 2022;173:4-11.
9. Aldabagh M., Wagle S., Cesa M., Yu A., Farooq M., Goldberg Y. Survival of In-Hospital Cardiac Arrest in COVID-19 Infected Patients. Healthcare (Basel) 2021;9(10):1315.
10. Sultanian P., Lundgren P., Strömsöe A., Aune S., Bergström G., Hagberg E., et.al. Cardiac arrest in COVID-19: characteristics and outcomes of in- and out-of-hospital cardiac arrest. A report from the Swedish Registry for Cardiopulmonary Resuscitation. Eur Heart J 2021;42(11):1094-1106.
11. Ippolitoa M., Catalisanoa G., Marinoa C., Fuca`a R., Giarratano A., Baldi E et.al. Mortality after in-hospital cardiac arrest in patients with COVID-19: A systematic review and meta- analysis. Resuscıtatıon 2021;164:122-129.
12. Lott C., Truhlář A., Alfonzo A., Barelli A., González-Salvado V., Hinkelbein J., et.al. ERC Special Circumstances Writing Group Collaborators. European Resuscitation Council Guidelines 2021: Cardiac arrest in special circumstances. Resuscitation. 2021;161:152-219.
13. Małysz M., Smereka J., Jaguszewski M., Dąbrowski M., Nadolny K., Ruetzler K., et.al. An optimal chest compression technique using personal protective equipment during resuscitation in the COVID-19 pandemic: a randomized crossover simulation study Kardiol Pol. 2020; 23:78(12):1254-1261.
14. Chan P S., Spertus J A., Kennedy K, Nallamothu B K, Starks M A, Girotra S. In-Hospital Cardiac Arrest Survival in the United States During and After the Initial Novel Coronavirus Disease 2019 Pandemic Surge. Circ Cardiovasc Qual Outcomes. 2022;15:e008420.
15. Aldabagh M., Wagle S., Cesa M., Yu A, Farooq M., Goldberg Y. Survival of In-Hospital Cardiac Arrest in COVID-19 Infected Patients. Healthcare 2021;9: 1315.
16. Merchant RM, Yang L, Becker LB., Berg RA., Nadkarni, V., Nichol, G. et.al. American Heart Association Get with the Guidelines-Resuscitation Investigators. Incidence of treated cardiac arrest in hospitalized patients in the United States. Crit. Care Med. 2011; 39:2401–2406.
17. Moreno Fernández-Ayala DJ, Navas P, López-Lluch G. Age-related mitochondrial dysfunction as a key factor in COVID-19 disease. Exp Gerontol. 2020;142:111147.
18. Liu K., Chen Y., Lin R., Han K. Clinical features of COVID-19 in elderly patients: A comparison with young and middle-aged patients. J. Infect. 2020;80:e14–e18.
19. Yang J.; Zheng Y., Gou X., Pu K., Chen Z., Guo, Q. et.al. Prevalence of comorbidities and its effects in patients infected with SARS-CoV-2: A systematic review and meta-analysis. Int. J. Infect. Dis. 2020; 94: 91–95.
20. Movahedi A., Mirhafez SR., Behnam-Voshani H., Reihani H., Ferns G.A., Malekzadeh J. 24-Hour survival after cardiopul- monary resuscitation is reduced in patients with diabetes mellitus. J. Cardiovasc. Thorac. Res. 2017; 9:175–178.
21. Zhu L., She ZG., Cheng X., Qin,- JJ., Zhang,XJ. Association of blood glucose control and outcomes in patients with COVID-19 and pre-existing type 2 diabetes. Cell Metab. 2020;31:1068–1077.e3.
22. Joseph L., Chan PS., Bradley SM,. Zhou Y., Graham G., Jones PG. Et.al. American Heart Association Get with the Guidelines-Resuscitation Investigators. Temporal changes in the racial gap in survival after in-hospital cardiac arrest. JAMA Cardiol. 2017;2:976-984.
23. Townsend M.J., Kyle TK., Stanford FC. Outcomes of COVID-19: Disparities in obesity and by ethnicity/race. Int. J. Obes. 2020;44:1807–1809.
24. Ranney, M.L.; Griffeth, V.; Jha, A.K. Critical Supply Shortages—The Need for Ventilators and Personal Protective Equipment during the Covid-19 Pandemic. N. Engl. J. Med. 2020, 382, e41.
25. Korkmaz,S., Kazgan,A., Çekiç S., Tartar AS., Balcı HN., Atmaca M. The anxiety levels, quality of sleep and life and problem-solving skills in healthcare workers employed in COVID-19 services. J. Clin. Neurosci. 2020; 80:131–136.
26. Özdemir L, Birbiçer H, Doruk H, Sagün A. Evaluation of Anxiety, Depression, and Work-Related Strain Inventory of Code Blue Teams in Turkey During the COVID-19 Pandemic: A Cross-Sectional Survey Study. Turk J Anaesthesiol Reanim. 2022;50(4):288-294.
27. Doruk N, Özdemir L, SagünA, Taşdelen B, Kök M, Yeşilmen E. Comparison of Two Different Early Warning Scores To Predict The Risk Of Cardiac Arrest in Patıents With Diagnosed COVID-19: Retrospective Analysis. TJR 2022;1(1):44-57.
28. Kaçar T, Demiraslan AT, Topçu İ, Keleş GT. COVID-19 Dönemine Ait Mavi Kod Uygulama Sonuçlarının Değerlendirilmesi. CBU-SBED 2022; 9(2): 234-238.
29. Arslan K., Şahin A S. Evaluation of Code Blue Calls in the Pre-Pandemic and Pandemic Period: A Tertiary Care Hospital Experience. İKSSTD 2022;14(3):214-220.
30. Kilicarslan N, Hande Gurbuz, Sermin Eminoglu, Sedef Elmas Arslan, Derya Karasu, Buket Ozyaprak, et.al. Comparison of Code Blue Practices Between the First Year of COVID-19 and the Previous Year. Med Bull Haseki 2022;60:211-219.

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