

Five Years of Experience in a Tertiary Hospital: Code Blue Üçüncü Basamak Hastanede Beş Yıllık Deneyim: Mavi Kod

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Summary

Objective: The early warning system used for situations requiring international resuscitation is the Code Blue protocol. Aim of the study is to evaluate the five-year implementation of the Code Blue protocol in a selected hospital and analyze the intervention process associated with it.

Material and Methods: In this study, Code Blue notifications made full-time at Mersin City Hospital between 1.January.2019 and 31.December.2023, were retrospectively reviewed. Inappropriate Code Blue notifications were excluded from the study.

Results: Over the five-year period from 2019 to 2023, a total of 2341 Code Blue notifications were recorded. Among these, Code Blue interventions resulted in 791 deaths, 835 intensive care unit (ICU) admissions, and 346 ward admissions. Additionally; 369 inappropriate Code Blue notifications were identified. The average response time was determined to be 141.8±5.44 seconds. In the study, 51.8% of 2341 code blue cases were determined to be female and 48.2% were male. The average age of patients given a code blue was determined to be 54.2. 57% of the code blue cases occurred outside of work hours and 43% during work hours.

Conclusion: In this study evaluating the five-year implementation of the Code Blue protocol, the rate of inappropriate notifications, the average response time, and the rate of cases resulting in death were found to be consistent with the literature. The most common reason for inappropriate Code Blue activation in the hospital was presyncope, whereas it is reported as syncope in the literature. The response time of the Code Blue team is crucial in ensuring complete recovery without sequelae in cases of in-hospital cardiac arrest, and it was observed that interventions in the hospital were performed within the required time frame.

Key words: Cardiopulmonary resuscitation, code blue, in-hospital cardiac arrest

Özet

Amaç: Uluslararası resüsitasyon gerekecek durumlar için kullanılan erken uyarı sistemi mavi kod uygulamasıdır. Bu çalışmanın amacı seçilmiş bir hastanede 5 yıllık mavi kod uygulamasını değerlendirerek mavi kod müdahale sürecini analiz etmektir.

Gereç ve Yöntem: Çalışmada 01/01/2019-31/12/2023 tarihleri arasında Mersin Şehir Eğitim ve Araştırma Hastanesi'nde tam zamanlı yapılan mavi kod bildirimleri retrospektif olarak incelenmiştir. Uygunsuz mavi kod bildirimleri çalışmanın dışında bırakılmıştır.

Bulgular: 2019-2023 tarihleri arasındaki 5 yılda toplamda 2341 mavi kod verilmiştir. Hastalarda mavi kod müdahalesi 791 vefat, 835 yoğun bakım ünitesi yatışı ve 346 hastada servis yatışı ile sonuçlanmıştır. Ek olarak; 369 uygunsuz mavi kod bildirimi yapılmıştır. Ortalama müdahale süresi 141,8±5,44 saniye olarak tespit edilmiştir. Çalışmada 2341 mavi kod olgusunun %51,8'i kadın, %48,2'si erkek olarak saptanmıştır. Mavi kod verilen hastaların ortalama yaşı 54,2 olarak tespit edildi. Mavi kod olgularının %57'si mesai dışında, %43'ü mesai içinde yaşanmıştır.

Tartışma: Çalışmada 5 yıllık mavi kod uygulaması değerlendirildiğinde uygunsuz mavi kod verilme oranı, mavi kod ortalama varış süresi ve exitus ile sonuçlanma oranı literatürle benzer bulunmuştur. En sık uygunsuz mavi kod verilme sebebi ise hastanede presenkop olup; literatürde senkop olarak saptanmıştır. Hastane içi yaşanabilecek kardiyak arrest durumlarında sekelsiz tam iyilik hali için mavi kod ekibinin müdahale süresi oldukça önemli olup; hastanede olması gereken süre zarfında müdahale yapıldığı görülmüştür.

Anahtar kelimeler: Kardiyopulmoner resüsitasyon, mavi kod, hastane içi kardiyak arrest

Kabul Tarihi: 29.Aralık.2024

Introduction

Code Blue is an internationally recognized code that signifies a medical emergency. It is an urgent

call system activated in situations where resuscitation may be required for a patient, a patient's relative, or healthcare staff. Initially implemented in the United States, it has since been adopted globally, with the same color code universally used (1). The Turkish Ministry of Health introduced the Code Blue system in Turkey in 2008 as part of healthcare quality improvement initiatives. Following the official notice issued by the Ministry of Health in 2009, with the regulation issued in 2011, the implementation of Code Blue became mandatory in hospitals. Since then, it has continued to be practiced, incorporating experiences gained over time and advancements in technology (2). The national Code Blue call number designated by the Ministry of Health is 2222. The same number is also used across Europe, and Turkey is among the first countries to implement this practice. To ensure timely and effective resuscitation interventions, the Code Blue team comprises physicians and anesthesia technicians trained specifically in Code Blue protocols. It is the responsibility of the unit activating the Code Blue to initiate basic life support interventions until the Code Blue team arrives. In cases requiring urgent medical intervention, the team is mobilized through the call system, and the call details, along with post-intervention developments, are recorded in the "Code Blue Incident Reporting Form" (3). In the hospital where the study performed; due to the large campus area, a rotational duty system is implemented under the administration of the hospital's chief physician, with dedicated Code Blue teams assigned to specific regions.

The Code Blue team is responsible for ensuring the proper functioning of the call system, implementing necessary measures, organizing training sessions and drills, and maintaining readiness for emergency response (4). An average of 200000 in-hospital cardiac arrests occur annually, with survival rates ranging between 11% and 35% (5). Effective and prompt intervention in Code Blue calls can significantly increase survival rates. In situations where the Code Blue intervention is not performed within 2-5 minutes and is delayed, the likelihood of sequelae in patients increases (6).

This study aims to analyze the Code Blue data from the past five years in a tertiary city hospital, focusing on the response time of the team to the scene, the appropriateness of the Code Blue notifications, and the outcomes of the

interventions in the cases where Code Blue was activated.

Material and Methods

This study was conducted in accordance with the Helsinki Declaration, following the approval of the Training and Planning Committee of Mersin City Training and Research Hospital and the ethical approval of the Toros University Ethics Committee (Decision No. 79, dated 22.04.2021).

The study retrospectively analyzed Code Blue notifications made full-time between January 1, 2019, and December 31, 2023, from three different areas of Mersin City Hospital: T1 Tower (General - Oncology and Psychiatry), Main Hospital Building, T2 Tower (General and Cardiovascular), and T3 Tower (Obstetrics and Pediatrics). In the mentioned hospital, the Code Blue system has been implemented as a call activation through the 2222 announcement number.

The study examined the data documented on the hospital's standard Code Blue form, including the patient's full name, age, gender, date, time of Code Blue activation, the unit where the activation occurred, the response time of the Code Blue team, the appropriateness of the call, and the patient's status after the event. Key variables analyzed included the patient's demographic details (age and gender), the time and location of the call, the response time of the team, and whether the call was deemed appropriate. Information extracted from the Code Blue notification forms encompassed the incident's date and time, the patient's demographic data, the unit initiating the call, the time of the call, and the team's arrival time at the scene. The response time of the team to the scene and the intervention outcomes were examined, while data from inappropriate Code Blue notifications were excluded from the study. The reasons for inappropriate Code Blue notifications were analyzed separately. Notifications with incomplete information in the Code Blue form were not included in the study.

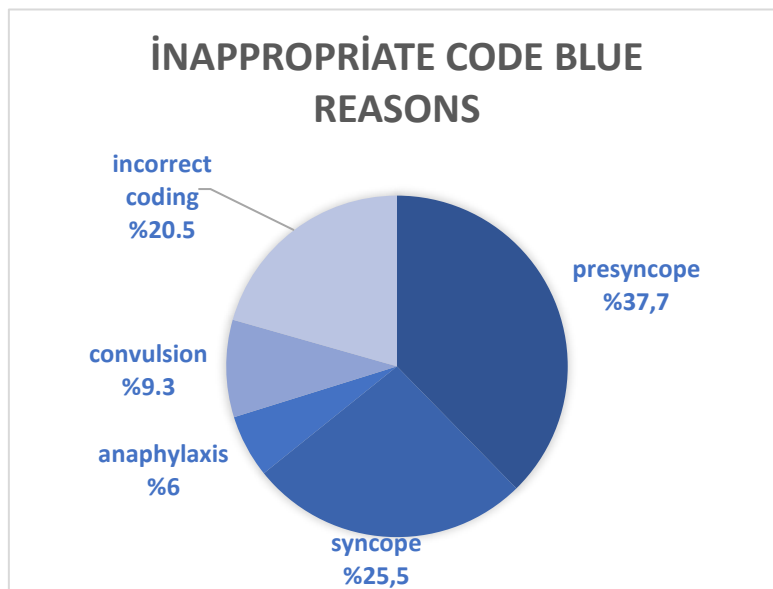
Results

Between 2019 and 2023, a total of 2341 Code Blue notifications were recorded. Analyzing the outcomes of these notifications: in 791 cases,

despite the intervention of the Code Blue team, the patients unfortunately passed away. In 835 cases, patients were transferred to the intensive care unit for observation and treatment following the Code Blue team's intervention. In 346 cases, the patients' condition stabilized after the Code Blue intervention, with those already admitted to the ward continuing their stay, while patients in outpatient care were admitted to the ward following their deterioration. This study also found that 369 inappropriate Code Blue notifications were made over the 5-year period. The rate of inappropriate Code Blue notifications by year was as follows: 15.9% in 2019, 20.5% in 2020, 16.5% in 2021, 15.9% in 2022, and 13.5% in 2023.

In the study, it was found that 51.8% of the 2341 Code Blue cases were female, while 48.2% were male. The mean age of participants was determined as 54.2 ± 7.3 years. Fifty-seven percent of the Code Blue cases occurred outside of working hours, while 43% occurred during working hours. The average response time for Code Blue notifications over the five-year period was determined to be 141.8 ± 5.44 seconds. In the study, the mortality rate was found to be 33.78%. When analyzing inappropriate Code Blue notifications, the causes identified were 20.5% due to keypad errors, 9.3% due to convulsions, 6% due to anaphylaxis, 37.7% due to presyncope, and 25.5% due to syncope (Figure-1).

Figure 1. Inappropriate Code Blue Reasons



Discussion

In studies related to Code Blue, the rate of inappropriate Code Blue notifications has been found to vary between 9.2% and 84.5% (7). In this study, the rate of inappropriate Code Blue notifications over the five-year period was found to be 15.76%, which is consistent with the findings in the literature.

The reasons for inappropriate Code Blue notifications include presyncope, syncope, anaphylaxis, convulsions, and incorrect coding. In a retrospective study by Demirci et al., the most common cause of inappropriate Code Blue

notifications was identified as syncope (8). In another study, the most common reason for inappropriate Code Blue notifications, accounting for 44.8%, was found to be syncope (4). In the study, the most common reason for inappropriate Code Blue notifications was identified as presyncope, accounting for 37.7%.

The maximum response time for a Code Blue notification is 3 minutes. To ensure this time frame is met, regular drills are conducted at the hospital. Additionally, quarterly meetings are held to address necessary system adjustments and resolve any potential issues. In the study by Tosyalı et al., the average response time for Code Blue was found to be 1 minute and 33 seconds (9). In the

study by Baytar et al., the average response time for Code Blue was found to be 92.37 ± 36.56 seconds (4). In the study, the average response time over the five-year period was determined to be 141.8 ± 5.44 seconds, which is consistent with the literature.

In the study conducted by Özüttürk et al., the rate of mortality following Code Blue interventions was found to be 39.1%, while in the study by Baytar et al., the mortality rate was 39.7% (10). In the study, the mortality rate following Code Blue interventions was found to be 33.78%.

In the performed study, 51.8% of the Code Blue cases were female, while 48.2% were male. Similarly, in the study conducted by Keleş et al., 53.9% were female and 46.1% were male. In another study by Baytar et al., 52.6% were female and 47.4% were male. Contrary to our findings, in the study by Özbilgin et al., 53.1% were male and 46.9% were female (11).

In the study, the mean age of patients was determined to be 54.2 ± 7.3 years. In the study conducted by Keleş et al., the mean age was reported as 44.2 ± 7.3 years, whereas in the study by Baytar et al., the mean age was slightly higher, at 74.7 ± 13 years (4,5).

57% of Code Blue notifications were reported outside working hours, while 43% were reported during working hours. Similarly, in the study by Baytar et al., 69% of Code Blue notifications occurred outside working hours, compared to 31% during working hours, indicating a higher proportion of notifications outside working hours. Likewise, in the study conducted by Tosyalı et al., 59% of Code Blue notifications were reported outside working hours, and 41% during working hours (5,9).

Conclusion

In conclusion, Code Blue management is a crucial quality standard for hospitals. It has been determined that the outcomes of the Code Blue implementation in our hospital are consistent with the data from international publications. The intervention time of the Code Blue team is critical for achieving complete recovery without sequelae in in-hospital cardiac arrest situations, and it has been observed that interventions were performed within the required time frame in our hospital. To ensure the continuity of these results, it is essential

to periodically update the training of the Code Blue team and conduct regular drills to assess the effectiveness of the Code Blue communication system. Additionally, providing basic life support training to all hospital personnel, beyond just the Code Blue team, is important for ensuring survival without sequelae.

Disclosure

Authors declared no financial support.

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Ethical approval

Approval for the study was obtained from the Toros University Clinical Research Ethics Committee dated 2024/79.

Authors' contributions

The study was planned by EO and MAE. The experiments were done by MSS and MAE contributed to the collection, analysis, and interpretation of the data. EO drafted the article and revised it. MAE gave final approval of the version to be published. All authors reviewed the manuscript.

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