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Analysis of "Code Blue" events in a single center: A cohort study with 419 incidents

Tek merkezde "Mavi Kod" olaylarının analizi: 419 vakalı kohort çalışma

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Abstract

Aim: Cardiac arrest sustains a significant cause of in-hospital morbidity and mortality worldwide and "Code Blue" (emergency code) is defined as a hospital code used to indicate a patient requiring immediate resuscitation. In this study we aimed to evaluate the ''code Blue'' events retrospectively in our hospital.

Methods: Data were collected from the file book that is contained the patients' name, protocol numbers, duration of arrivals to the arrest locale, final results of CPR and the CPR team's names, locales of "code blue". Patients' gender, locales of "code blue", false or right "code blue" situations, final results were analyzed.

Results: One hundred-nineteen "code blue" situations were analyzed, 132 of 339 true "code blue" patients died at the locale after CPR. One hundred-forty four patients were transferred to reanimation unit, 29 were to the coronary intensive care unit (ICU), 28 were to the cardio-vascular surgery ICU, four were to pediatric-ICU and two were taken to the emergency operations. Also 113 of these 207 remaining patients were died in these units in later times, 94 patients survived. Eighty of them were determined as false code blue.

Conclusions: Even the situation is in-hospital cardiac arrest and the CPR is performed by skilled team mortality rate may still be high. To prevent the false code blue situations, in-house training is indispensable for every hospital workers.

Keywords: Code Blue, In-hospital arrest, False Code Blue, Resuscitation

Öz

Amaç: Kardiyak arrest, dünya çapında hastane içi morbidite ve mortalitenin önemli bir nedenini olup "Mavi Kod" (acil durum kodu), hemen resüsitasyon gerektiren bir hastayı belirtmek için kullanılan bir hastane kodu olarak tanımlanmaktadır. Bu çalışmada, hastanemizde verilen mavi kodları retrospektif olarak değerlendirmeyi amaçladık.

Yöntemler: Çalışma verileri, hastanın adının, protokol numaralarının, olay yerine varış sürelerinin, resüsitasyon ekibinin adlarının, olay yerinin olduğu "Mavi Kod" defterinden toplandı. Hastaların cinsiyeti, "Mavi Kod" bölgelerinin yerleri, yanlış veya doğru "Mavi Kod" durumları, hastaların nihai sonuçları analiz edildi.

Bulgular: 419 "Kod mavi" durumu incelendi, 339 hastanın 132'sinin olay yerinde resüsitasyon sonrasında öldüğü görüldü. Yüz kırk dört hasta reanimasyon ünitesine, 29'u koroner yoğun bakıma, 28'i kalp-damar cerrahisi yoğun bakımına, 4'ü pediatrik yoğun bakıma ve 2'si acil operasyona alındı. Ayrıca bu 207 hastanın 113'ü bu birimlerde daha sonra öldü, 94 hasta hayatta kaldı. Seksen, mavi kod yanlış olarak belirlendi.

Sonuçlar: Kardiyak arrest durumu hastane içinde bile olsa ve resüsitasyon yetenekli bir ekip tarafından yapılsa bile ölüm oranı hala yüksektir. Yanlış mavi kod durumlarını önlemek için, tüm hastane çalışanlarına kurum içi eğitimler vazgeçilmezdir.

Anahtar kelimeler: Mavi kod, Hastane içi arrest, Yanlış mavi kod, Resüsitasyon

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Introduction

Cardiac arrest sustains a significant cause of in-hospital morbidity and mortality worldwide [1]. Considering significant therapeutic advances, survival-to-discharge rates remain in the range of 17–32% [2–6]. Numerous factors have been found to influence survival after in-hospital cardiac arrest, including age, comorbidities, the duration of arrival to the arrest locale, the duration of cardiopulmonary resuscitation (CPR) [2,6,7]. Most of these factors describe pre-existing conditions that cannot be easily controlled by the resuscitation team or hospital. Also CPR teams' skill and education are very important for the success rate of CPR [8]. "Code Blue" (emergency code) is defined as a hospital code used to indicate a patient requiring immediate resuscitation. In this study we aimed to evaluate the ''Code Blue'' events retrospectively in our hospital.

Materials and methods

The present retrospective study was conducted at Sanko University, Faculty of Medicine. The approval of the Institutional Ethics Committee of Sanko University, Gaziantep, Turkey was obtained for the study.

This study was an analysis of retrospectively collected data of all ''Code Blue'' events in one hospital from January 2012 to November 2018. The institution is a large inner-city hospital, have a surgical intensive care-reanimation unit (RU), a cardiology intensive care (C-ICU), cardiovascular surgery intensive care (CVS-ICU), and pediatric intensive care (P-ICU), an average inpatient census of 650 patients.

"Code blue" team includes two reanimation unit nurses, two anesthesia technicians and an anesthesiologist. There are two "Code blue" devices, one of these is in operating room and other is in reanimation unit. They both rings at the same time and they show the locale of the "Code blue". Reanimation nurses takes a CPR kit includes drugs, bag-valve-mask, laryngoscopy kit, intubation tubes, airways. Also there are CPR kits and defibrillators in all services. Cardiac arrest was defined as the cessation of cardiac mechanical activity as confirmed by lapse in circulation, which was determined by the absence of a palpable central pulse, unresponsiveness, and respiratory arrest defined as apnea. The resuscitation protocol begin immediately as stated in the AHA (American Heart Association) guidelines, till the blue code team arrives to the locality.

After CPR, if pulse and blood pressure is back and normal, patients are taken to the appropriate intensive care units. After CPR, patient's name, protocol number, duration of arrival to the arrest locale, final result of CPR and the CPR team's names, locales of "Code blue" are recorded to the file. Data were collected from this file book.

Patients' gender, locales of "Code blue", false or right "Code blue" situations, final results and the duration of arrival to the locale were analyzed. When we arrived to the locale, if patient is stable and was not neither respiratory nor cardiac arrested, it was accepted as false code blue.

Results

In this study, 419 "Code blue" situations were analyzed retrospectively between January 2012 and November 2018 in Sanko University, Faculty of Medicine Hospital. Eighty of these codes were noticed as false (table 1).

After minimum 45 minutes CPR duration, 132 of 339 patients couldn't be saved and died at the locale. After CPR, when pulse and blood pressure is back and normal, 207 patients were taken to the appropriate units (table 2). One hundred-forty four patients were transferred to RU, 29 were to the C-ICU, 28 were to the CVS-ICU, 4 were to P-ICU and 2 were taken to the emergency operations.

Table 1: General "Code Blue" analysis

	n	Female/Male
True code blue	339	131/208
False code blue	80	54/26

Table 2: Departments of patients that transferred to, and their outcomes

	n	Alive	Death
Total	207	94	113
RU	144	62	82
CVS-ICU	28	17	11
Coronary-ICU	29	14	15
Pediatric -ICU	4	0	4
Emergency surgery	2	1	1

RU: Reanimation unit, ICU: Intensive care unit, CVS: Cardio-Vascular Surgery

Also 113 of these 207 remaining patients were died in these units in later times, 94 patients survived. Sixty-two of 144 patients taken to the RU were survived, 17 of 28 patients taken to the CVS-ICU were survived, 14 of 29 patients taken to the C-ICU were survived and 1 of 2 patients undertaken to the emergency operation was survived.

Table 3: "Code Blue" analysis of departments

Department which is the incident occurred	n	Death/Died at the locale	Transfer to department after CPR	False "Code Blue"
CVS-ICU	32	19	13-Stayed in CVS-ICU	0
Emergency room	138	65	59-RU 2-Emergency surgery 10-coronary ICU 2-Pediatric ICU	0
Cardiology clinic	42	2	14- Coronary ICU 36-RU	0
CVS clinic	21	4	9- CVS-ICU 8-RU	0
Radiology	7	0	3-RU	4
Transplantation unit	3	2	1-RU	0
Coronary angiography and catheterization unit	9	2	4- Coronary ICU 2- CVS-ICU	1
Pediatric clinic	2	0	2- Pediatric -ICU	0
Coronary ICU	47	24	19-RU 4- CVS-ICU	0
Other clinics	33	14	16-RU	3
Out-patient clinic	77	0	2-RU 1- Coronary ICU	72

RU: Reanimation unit, ICU: Intensive care unit, CVS: Cardio-Vascular Surgery

Locales of where code blues were assigned are analyzed (table 3). One hundred-thirty eight "code blue" were assigned in emergency room, 65 died at the locale, 59 of survived patients transferred to RU, 2 of transferred to operating room, 10 of transferred to C-ICU, 2 of transferred to P-ICU. Forty-seven "code blue" were assigned in C-ICU, 24 died at the locale, 19 of survived patients transferred to RU, 4 of survived patients transferred to CVS-ICU. Thirty-two "code blue" were assigned in CVS-ICU, 19 died at the locale and 13 stayed in the ICU. Forty-two "code blue" were assigned in cardiology service, 2 died at the locale, 14 of survived patients transferred to C-ICU, 36 of transferred to RU. Twenty-one "code blue" were assigned in cardiovascular surgery service, 4 died at the locale, 9 of survived patients transferred to CVS-ICU, 8 of transferred to RU. Seven "code blue" were assigned in radiology department, 4 were determined as false code blue, 3 of transferred to RU, no one died. Three "code blue" were assigned in transplantation

department, 2 died at the locale, 1 of transferred to RU. Nine "code blue" were assigned in coronary angiography unit, 2 died at the locale, 1 of determined as false code blue, 4 of transferred to C-ICU and 2 of survived patients transferred to CVS-ICU. Two "code blue" were assigned in pediatric service, 2 of survived patients transferred to P-ICU. Thirty-three "code blue" were assigned in other services, 14 died at the locale, 3 of determined as false code blue, 16 of survived patients transferred to RU. Seventy-seven "code blue" were assigned in outpatient clinics, no one died at the locale, 72 of determined as false code blue, 2 of survived patients transferred to RU, 1 of survived patients transferred to C-ICU.

When the false code blue situations were analyzed, 72 of these were assigned by secretaries of outpatient clinics, 3 of these were assigned by nurses, 1 was assigned by coronary angiography technician, 4 were by radiology technicians.

Gender proportion of true code blues was 131/208 (female/male) but just the opposite the proportion of false code blues was 54/26 (female/male).

Discussion

Even it is in-hospital cardiac arrest mortality rate is still higher. Shin et al. studied in-hospital cardiac arrest events of 958 patients and found that %28 of these patients were survived and discharged [9]. Similarly %27.7 of our patients were survived and discharged. Also the rate of successful CPR is as low as 2.4%−18.4% [10-15] although most studies reported a successful CPR rate of 13%−59% [8]. In our study successful CPR rate at first attempt is 61%. We consider this is due to educated skills of CPR teams [anesthesiologist, anesthesia technician and reanimation unit nurse] and their level of competence in resuscitation together with the short duration of arrival to the arrest locale (38.7 second min:10 sc max:180sc).

In-hospital cardiac arrests are common and delayed treatment is associated with a lower survival rate and poor neurological outcomes. Furthermore, early recognition of "code blue" situation is important for the safety of the patients. The results of our study show that factors such as type of education, affect decision to activate code blue [16]. In our study, 72 of 80 false "code blue" situations were assigned by the secretaries of outpatient clinics and they were not educated.

Cardiac symptoms, such as chest pain, shortness of breath, tachycardia and weakness, are very common in general population. Cardiac symptoms may be related to organic heart disease or may be associated with a variety of physical or mental conditions. But in some cases the cause of cardiac symptoms remains unclear. In these situations there is a high probability that patients' symptoms (especially chest pain) are related to psychological background. Anxiety disorders such as panic disorder, depression and conversion disorders can be evaluated as urgent with non-cardiac chest pain [17]. These disorders are also associated with deterioration of oxidative metabolism as well as with psychopathological mechanisms and also conversion is associated increased neuronal damage [18,19]. Psychogenic respiratory distress is superimposed on psychogenic neurologic symptoms like these psychopathologies and misdiagnosis resulted in code blue alerts [20,21].

Sobański et al. [22] studied Neurotic personality and pseudo-cardiac symptoms, their study group consisted of 2,450 patients, and 69% of them were women, while 31% were men. Similarly in our study, in false code blue situations women were more than men. Gender proportion of true code blues was 131/208 (female/male) but just the opposite the proportion of female/male was 54/26. Most of false code blues were in outpatient clinics. Panic attacks, conversion disorders, psychiatric illnesses, neurotic behaviors were diagnosed by the CPR team, but secretaries of outpatient clinics were not able to recognize these diagnosis.

Our study has several limitations because it is a single-center, retrospective study. The results of the study are unique to our hospital. We did not study the exact reasons of arrests, but 150 of 339 true "code blue" situations were assigned from coronary and Cardio-Vascular Surgery ICU, coronary and Cardio-Vascular Surgery services. These findings gave rise to thought that causes should be cardiac problems. Also similarly, studies showed that cardiac problems are the most reason in cardiopulmonary arrests [23].

Conclusion

In conclusion, even the situation is in-hospital cardiac arrest and the CPR is performed by skilled team mortality rate may be still high. To prevent the false code blue situations, in-house trainings are indispensable for every hospital workers.

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