

A Study on the Success and Other Correlates of Code Blue Cases in a Multi-specialty Teaching Hospital in Bihar

Manasij Mitra¹, Dipak Sinha², Nupur Biswas³, Maitraye Basu⁴

ABSTRACT

Introduction: “Code blue” (CB) is common emergency code, used by hospitals to alert trained emergency response team of any cardiac arrest. The factors affecting the outcome of resuscitative services are inherent to the patient and also to the functioning of the Code Blue System (CBS). The primary objective was to assess the success of ‘Code Blue’ in terms of survival. The other objective was to identify the patient and system variables associated with a favorable outcome.

Material and methods: This was a cross sectional retrospective study done in a multispecialty teaching hospital in Bihar during the period from April 2018 to March 2019. The study was conducted after approval from the Institutional Ethics Committee. Data was gathered from the Code Blue Report Form and further details of individual patients were tracked from their medical records. Data was entered in an Excel Spreadsheet and analyzed using descriptive statistics, Chi-square test and logistic regression analysis using SPSS Version 21 software.

Results: A total of 111 CB calls were initiated during the period. Code Blue activated for cardiac arrest situations only were considered in the study. Emergency response calls for physiologically acute changes in the patients were excluded. Immediate success of resuscitation services for Code Blue calls was 63.06%, beyond 24 hours this was 27.03% and at discharge this was just 9.01%. Factors such as age, time of Code Blue during or outside routine hospital working hours, associated comorbidities, procedures like dialysis, operation or chemotherapy done in the last 24 hours preceding the Code Blue and duration of CPR were found to have a significant effect on the success rate.

Conclusion: We conclude, that formal training of all the healthcare providers on BLS is of paramount importance. Further in depth analysis is required to find out the root cause of the problems that are associated with the ‘Code Blue’ process which is affecting the success rates beyond routine hospital working hours.

Keywords: Cardiac Arrest, Cardiopulmonary Resuscitation, Code Blue

INTRODUCTION

The use of color codes to designate emergencies to alert trained specific teams and respond quickly to those emergencies thereby preventing stress or panic around is an established process in hospitals across the globe.¹

‘Code Blue’ is one such common hospital emergency code. It generally indicates a medical emergency like a cardiac arrest requiring a trained team of advanced life support providers to rush to the specific location and begin immediate

resuscitative efforts.^{2,3}

Early initiation of cardiopulmonary resuscitation (CPR) and defibrillation are critical for improving survival. Every minute of delayed treatment decreases survival by 10%.⁴

The incidence of in-hospital cardio-respiratory arrest has been estimated to be 1–5 events per 1000 annual hospital admissions.⁵ It is estimated that approximately 2, 00,000 patients experience an in-hospital cardiac arrest every year in United States.⁶

There are established guidelines widely accepted and used internationally which provide logical, sequential algorithms for advanced cardiac life support (ACLS). Training and certification is also standardized almost universally. Yet outcomes are variable.⁷

Rate of successful CPR has been reported to be as low as 2–6% also in some studies even for in-hospital cardiac arrests.⁸ Other studies have reported widely variable successful CPR rates from 13%–59%.⁹ Survival to hospital discharge rate is a mere 0.42%.¹⁰

This indicates there are numerous factors which are inherent to the patient and also external factors which may influence the functioning of the ‘Code Blue’ process and the quality of CPR and thus determine the outcome.¹¹ It is therefore essential to regularly audit and evaluate the ‘Code Blue’ services.¹² Further studies in Indian settings on the functioning of ‘Code Blue’ systems is scarce.

The current study was undertaken to analyze the ‘Code Blue’ system and identify variables associated with survival at our multispecialty tertiary care hospital. The primary objective was to assess the success of ‘Code Blue’ in terms of survival. The other objective was to identify the patient and system variables associated with a favorable outcome and identify

¹Associate Professor, Department of Anesthesiology, MGM Medical College and LSK Hospital, Kishanganj, ²Associate Professor, Department of Anesthesiology, MGM Medical College and LSK Hospital, Kishanganj, ³Professor and HOD, Department of Anesthesiology, MGM Medical College and LSK Hospital, Kishanganj, ⁴Junior Resident, Department of Biochemistry, MGM Medical College and LSK Hospital, Kishanganj, India

Corresponding author: Dr Maitraye Basu, Junior Resident, Department of Biochemistry, MGM Medical College and LSK Hospital, Kishanganj, India

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the practical problems associated with establishment and functioning of a Code Blue system.

MATERIAL AND METHODS

This was a cross sectional retrospective study done in a multispecialty teaching hospital in Bihar during the period from April 2018 to March 2019. Data was gathered from the Code Blue Report Form which had the demographic data, time of Code Blue call, area of Code Blue and the response time of the Code Blue Team. Further details of individual patients like initial rhythm at the time of Code Blue, any procedures preceding Code Blue, Outcome of the resuscitative measures with follow up were tracked from their medical records. Code Blue activated for cardiac arrest situations only were considered in the study. Emergency response calls for physiologically acute changes in the patient's mental status, respiratory rate, heart rate, oxygenation, blood pressure, hypoxia, and chest pain were excluded.

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 as per the AHA 2015 guidelines.

The Hospital has a laid down protocol of responding to a 'Code Blue' situation. Any health staff (doctor, nurse or auxiliary staff like patient transporters, paramedics) can activate the Code Blue from any area of the hospital through the nearest telephone extension. As per protocol of the hospital, Code Blue is activated across the hospital outside Emergency, Critical Care units and Operation theatre which have dedicated stationed Advanced Cardiac Life Support (ACLS) providers. There is a dedicated hotline number through which all 'Code Blue' calls are handled followed by subsequent alert of the respective Code Blue team members as per duty roster. The 'Code Blue' team consists of ACLS trained doctors from the department of anesthesiology, emergency medicine and critical care units along with nursing staffs, pharmacists and allied personnel. The team leader from the physician pool of the Code Blue team is responsible for directing the resuscitation services.

As per protocol if arrest is detected, resuscitation will begin immediately by the local care providers and continue as per Basic Life Support (BLS) Guidelines till the Blue Bode team arrives to the particular unit and takes charge of the resuscitation services. Resuscitation Services were provided as per AHA Guidelines 2015.

The immediate success of 'Code Blue' was considered as Return of Spontaneous Circulation (ROSC) and sustainability beyond 4 hours; survival beyond 24 hours and till discharge was also considered. Code Blue cases who did not have ROSC or where ROSC was not sustained beyond 4 hours was considered as unsuccessful.

The study protocol was approved by the Institutional Ethics Committee before the start of the study.

Review of Code Blue Report forms revealed a sample size of 111 after considering the exclusion criteria. Code Blue calls below 18 years were excluded. 10 cases were excluded as those were not true cardiac arrest situations.

The data was entered and recorded in a Microsoft Excel 2013 file and analyzed using the SPSS version 21. Descriptive statistics and Chi-square test were used to the data.

RESULTS

Immediate success of resuscitation services for Code Blue calls was 63.06%, beyond 24 hours this was 27.03% and at discharge this was just 9.01%.

The sex distribution of Code Blue cases reveals males 72.1% and females 27.9% (Figure 1). The outcome of resuscitation services in terms of immediate success of Code Blue cases was more in males (48, 68.57%) vis a vis (22, 31.43%) in females and this difference was statistically significant (p value=0.000). This outcome however got reversed at discharge. The survival rate at discharge was more in females

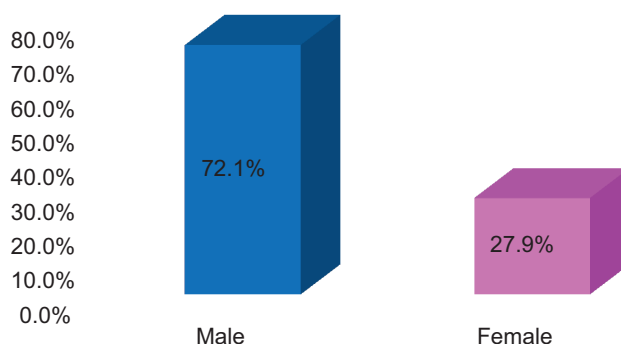


Figure-1: Sex Distribution of Code Blue Cases

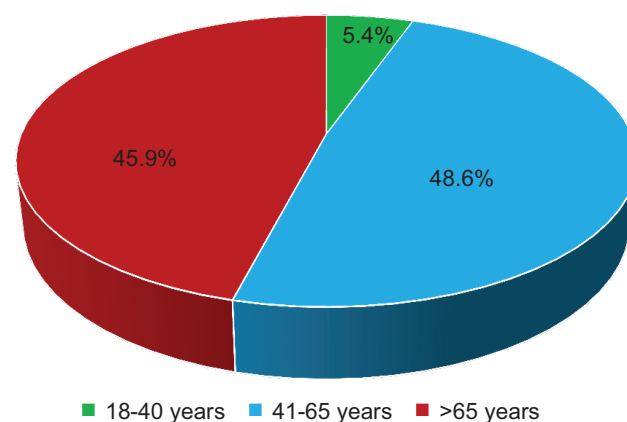


Figure-2: Age wise Distribution of Code Blue cases

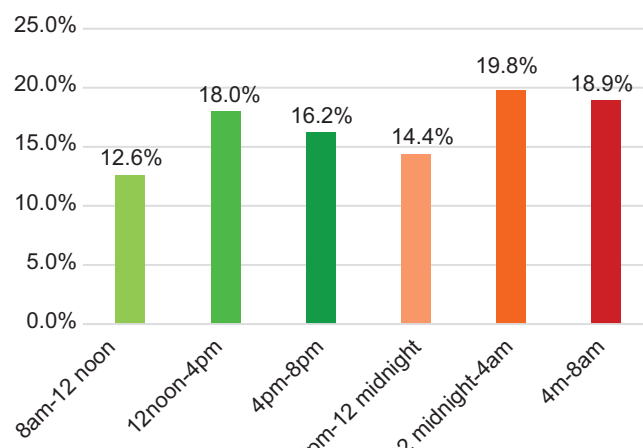


Figure-3: Time Distribution of Code Blue Calls

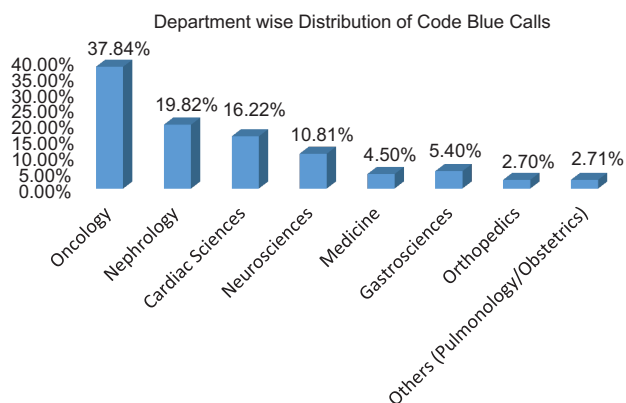


Figure-4: Department wise Distribution of Code Blue Calls

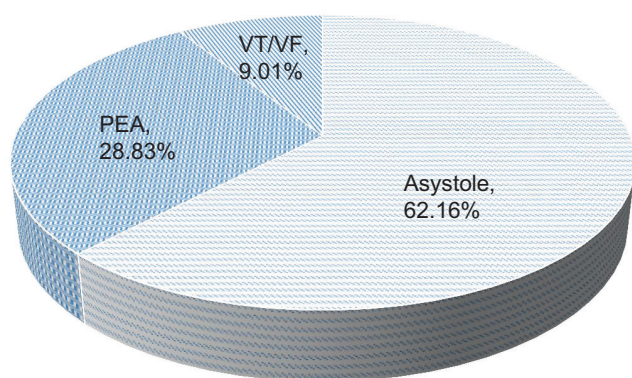


Figure-5: Initial Rhythm

(6, 60%) vis a vis males (4, 40%) (p value=0.000<0.05).

The mean age of the patients for Code Blue was 64.06 years (\pm 9.96 Standard Deviation), range 18 -90 years. The Age Distribution of Code Blue cases was 5.4% in the age group of 18-40 years, 48.6% in the age group of 41-65 years and 45.9% in the age group of >65 years (Figure 2).

The success of resuscitation depended on the age of the patients with immediate success rates declining in the age group of >65 years (30, 42.86%) against that in the age group \leq 65 years (40, 57.14%) and this difference was statistically significant. (p value=0.000<0.05). This difference was more evident in the survival rate at discharge. In the age group \leq 65 years, it was (8, 80%) against those with age > 65 years being (2, 20%). This difference was also statistically significant (p value=0.000<0.05). Logistic Regression Analysis substantiated the same. The odds of the immediate success rate of resuscitation was 1.5 times more in the age group \leq 65 years. This difference was more evident in the survival rate at discharge where the odds of survival at discharge being 4 times more in patients in the age group \leq 65 years.

The time Distribution of Code Blue Calls was 12.6% between 8AM to 12 noon, 18% between 12 noon to 4 PM, 16.2% between 4PM to 8 PM, 14.4% between 8PM to 12 midnight, 19.8% between 12 midnight to 4AM and 18.9% between 4AM to 8AM (Figure 3). The outcome of resuscitation in terms of immediate success was dependent on the time of occurrence of Code Blue with unsuccessful immediate resuscitation being (11, 27.5%) during the routine hospital

working hours of 8AM to 8PM vis a vis that (30, 72.5%) after hospital working hours of 8PM to 8AM. This difference was also statistically significant. (p value=0.000<0.05). The success rate was better in terms of discharge in patients who had Code Blue during routine hospital working hours of 8AM to 8PM (7, 70%) against those who had Code Blue after hospital working hours of 8PM to 8 AM (3,30%). This difference was statistically significant (p value=0.000<0.05). This could be due to delayed communication and response to Code Blue calls, team efficiency and competence beyond routine hospital working hours which could have affected the quality of resuscitation services.

The department wise distribution of Code Blue calls is depicted in the Figure 4.

Initial Rhythm at the time of Code Blue is depicted in the Figure 5. Rate of immediate success of resuscitation services was more where initial rhythm was Asystole (39, 55.71%), followed by Pulseless Electrical Activity (PEA) (20, 28.57%), VT/VF (6, 8.57%) and Bradycardia (5, 7.14%) but this difference did not turn out to be statistically significant in our study (p value= 0.495<0.05)

The immediate success of resuscitation was better in patients without comorbidities (42, 60%) against that in patients with comorbidities (28, 40%) and this difference was statistically significant (p value=0.000<0.05). This was also evident at discharge with the success rate at discharge in patients without comorbidities (8, 80%) vis a vis those with comorbidities (2, 20%) and this was statistically significant (p value=0.000<0.05). Logistic Regression Analysis, revealed a similar picture. The odds of the immediate success of resuscitation was 1.75 times more in patients without comorbidities. This was also evident on survival at discharge. The odds of survival at discharge was 2.5 times more in patients without comorbidities.

The immediate success of resuscitation was more where response time by Code Blue team was within 3 mins (44,62.86%) against the response time of > 3 mins (26, 37.14%) but this difference was not statistically significant (p value=0.46<0.05) though. This could be due to the well established process of first response in the hospital where all the staffs are Basic Life Support (BLS) trained. The success of resuscitation was better in terms of survival at discharge in cases where response time was within 3 mins (10, 9.01%) vis a vis those with response time >3mins having nil survival at discharge (0,0%). This difference however was statistically significant. (p value=0.006<0.05).

The outcome of resuscitation in terms of immediate success was better in patients who did not have any procedure like dialysis or Operation or Chemotherapy within the last 24 hours of resuscitation (60, 85.71%) against patients who had a procedure like dialysis or Operation or Chemotherapy in the last 24 hours (10, 14.29%) and this difference was statistically significant. (p value=0.000<0.05).

The outcome of resuscitation in terms of immediate success was better in patients where the doctors attended the patient within last 4 hours (50, 71.43%) vis a vis those patients where the doctor did not attend in the last 4 hours (20,

28.57%). This difference was statistically significant. (p value=0.000<0.05).

Duration of resuscitation was > 20 mins in all the cases in consonance with the established guidelines.

DISCUSSION

Factors such as age, time of Code Blue during or outside routine hospital working hours, associated comorbidities, procedures like dialysis, operation or chemotherapy done in the last 24 hours preceding the Code Blue and duration of CPR were found to have a significant effect on the success rate.

Immediate success of resuscitation services for Code Blue calls was 63.06%, beyond 24 hours this was 27.03% and at discharge this was just 9.01%.

Our study is also consistent with the findings from other studies which reported that survival rate after cardiac arrest declined significantly with increase in age.^{13,14}

There is a scope of improvement on the quality of resuscitation services beyond routine working hours of the hospital from 8 PM to 8 AM. This finding points out to a very important aspect which requires further in depth analysis to find out the root cause for targeted interventions.

Asystole was the predominant rhythm at the time of 'Code Blue' which was consistent with other studies.¹⁵

Though studies pointed out that presenting rhythm significantly affected the survival of the patient after cardiopulmonary arrest,^{16,17} our findings deviated from the same.

Unlike studies which did not find any significant effect of gender on the success rate, our findings were consistent with the findings of studies which reported that gender was a predictor of survival after cardiac arrest.¹⁸

Our study revealed that though response time to Code Blue calls did not affect the immediate success rate, the success of resuscitation was better in terms of survival at discharge in cases where response time was within 3 mins. This was consistent with other studies as well.¹⁹

LIMITATIONS

This study included only the adult 'Code Blue' calls. 'Code Blue' calls in this study included situations of cardiac arrest outside Emergency, Critical Care Units and the Operation Theatre which had stationed staff trained in Advanced Cardiac Life Support Systems. Hence success of resuscitation services across the hospital could not be evaluated.

Condition of cerebral function was not reviewed as a parameter for successful CPR.

As it was a retrospective study, the quality of resuscitation services like effectiveness of chest compression during CPR, delays in airway control and complication rate following CPR could not be analyzed.

CONCLUSION

Though the immediate success rate of Code Blue calls was quite high, it decreased by more than 50% by the first 24 hours with survival at discharge being 9.01%. Formal training of all the healthcare providers on BLS is of paramount importance.

Further in depth analysis is required to find out the root cause of the problems that are associated with the 'Code Blue' process which is affecting the success rates beyond routine hospital working hours.

REFERENCES

- Eroglu SE, Onur O, Urgan O, Denizbasi A, Akoglu H. Blue code: Is it a real emergency?. *World J Emerg Med.* 2014;5:20–23.
- Al-Aboud KM, Al-Aboud DM. Hospital emergency codes. An appraisal. *Saudi Med J.* 2010;31:1377.
- Barbetti J, Lee G. Medical emergency team: A review of the literature. *Nurs Crit Care.* 2008;13:80–5.
- Ali B, Zafari AM. Narrative review: cardiopulmonary resuscitation and emergency cardiovascular care: review of the current guidelines. *Ann Intern Med.* 2007; 147:171–179.
- Sandroni C, Nolan J, Cavallaro F, Antonelli M. In-hospital cardiac arrest: Incidence, prognosis and possible measures to improve survival. *Intensive Care Med.* 2007;33:237–45.
- Merchant RM, Yang L, Becker LB, Berg RA, Nadkarni V, Nichol G, Carr BG, Mitra N, Bradley SM, Abella BS, Groeneveld PW; American Heart Association Get With The Guideline–Resuscitation Investigators. Incidence of treated cardiac arrest in hospitalized patients in the United States. *Crit Care Med.* 2011; 39:2401–2406.
- Brahmajee K, Nallamotheu, Timothy C. Guetterman, Molly Harrod, Joan E. Kellenberg, Jessica L. Lehrich, Steven L. Kronick, Sarah L. Krein, Theodore J. Iwashyna, Sanjay Saint and Paul S. Chan. How Do Resuscitation Teams at Top-Performing Hospitals for In-Hospital Cardiac Arrest Succeed? A Qualitative Study. Originally published 9 Jul 2018. <https://doi.org/10.1161/CIRCULATIONAHA.118.033674> *Circulation.* 2018;138:154–163
- Sodhi K, Singla MK, Shrivastava A. Impact of advanced cardiac life support training program on the outcome of cardiopulmonary resuscitation in a tertiary care hospital. *Indian J Crit Care Med.* 2011;15:209–212.
- Predictors of survival following in-hospital adult cardiopulmonary resuscitation.
- Brindley PG, Markland DM, Mayers I, Kutsogiannis DJ. *CMAJ.* 2002; 167:343-8.
- Abe T, Tokuda Y, Ishimatsu S SOS-KANTO study group. Predictors for good cerebral performance among adult survivors of out-of-hospital cardiac arrest. *Resuscitation.* 2009;80:431–6.
- Bolandparvaz SH, Mohammadzadeh A, Amini A, Abbasil HR, Ahmadi MM, Ghaffaripour S. Cardiopulmonary arrest outcome in Nemazee hospital, Southern Iran. *IRCMJ.* 2009;11:437–4.
- Spearpoint KG, Gruber PC, Brett SJ. Impact of the immediate life support course on the incidence and outcome of in-hospital cardiac arrest calls: An observational study over 6 years. *Resuscitation.* 2009;80:638–43.
- Outcome and cost-effectiveness of cardiopulmonary resuscitation after in-hospital cardiac arrest in octogenarians. Paniagua D, Lopez-Jimenez F, Londoño JC, Mangione CM, Fleischmann K, Lamas G.

- Cardiology. 2002; 97:6-11.
15. Survival after In-Hospital Cardiopulmonary Resuscitation in a Major Referral Center during 2001-2008. Rafati H, Saghafi A, Saghafinia M, Panahi F, Hoseinpour M. *Iran J Med Sci.* 2011; 36:50-3.
 16. Monangi S, Setlur R, Ramanathan R, Bhasin S, Dhar M. Analysis of functioning and efficiency of a code blue system in a tertiary care hospital. *Saudi J Anaesth.* 2018;12:245–249.
 17. Rhythms and outcomes of adult in-hospital cardiac arrest. Meaney PA, Nadkarni VM, Kern KB, Indik JH, Halperin HR, Berg RA. *Crit Care Med.* 2010; 38:101-8.
 18. Analysis of clinical outcomes following in-hospital adult cardiac arrest. Cohn AC, Wilson WM, Yan B, Joshi SB, Heily M, Morley P, Maruff P, Grigg LE, Ajani AE. *Intern Med J.* 2004; 34:398-402.
 19. Is there a difference between women and men in characteristics and outcome after in hospital cardiac arrest? Herlitz J, Rundqvist S, Bång A, Aune S, Lundström G, Ekström L, Lindkvist J *Resuscitation.* 2001; 49:15-23.
 20. Hisham M, Sivakumar MN, Sureshkumar T, Kumar RS, Sathesh A. Attention Code Blue: a comprehension of in-hospital cardiac arrest from a multispeciality hospital in South India. *Crit Care.* 2015;19:P412.

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