

# A Clinical Audit to Assess the Adherence of the Code Blue Team to Advanced Cardiac Life Support Protocol and its Effect on the Patient Outcome in a Tertiary Care Hospital in Kochi, Kerala

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## Abstract

**Introduction:** Cardiopulmonary resuscitation is a sequence of techniques that combines chest compression with artificial ventilation to manually maintain the circulation to preserve intact brain function. The aim is to maintain circulation and breathing in a person who is in cardiac arrest until emergency aid arrives. Effective teamwork by Code Blue team raises chances of a successful outcome. The advanced cardiac life support (ACLS) guidelines were developed by the American Heart Association using the comprehensive review of resuscitation literature performed by the International Liaison Committee on Resuscitation. **Aim:** To assess adherence of Code Blue team to ACLS protocol, to assess outcome of resuscitation, and to compare outcome between those where ACLS guidelines were followed and those not followed. **Patients and Methods:** A clinical audit was done between 2014 and 2015 at Lourdes Hospital, Kochi, on inpatients aged between 30 and 80 years, with witnessed cardiac arrests/respiratory arrest. Pregnant and unwilling patients were excluded. **Results:** The common arrest rhythm was pulseless electrical activity, followed by asystole. ACLS protocol was followed in 58.7%. The most common deviation was usage of inappropriate drugs. Return of spontaneous circulation (ROSC) was attained in 53.3%, of which 28.5% were discharged ( $P < 0.05$ ), which suggests a significant association between the adherence to ACLS protocol and ROSC. **Conclusion:** Although Code Blue team is ACLS trained, deviations occurred in nearly half of the resuscitations, which need to be reduced. Outcome was better in those resuscitations where the ACLS protocol was followed.

**Keywords:** Advanced cardiac life support protocol, cardiopulmonary resuscitation, cardiorespiratory arrest, Code Blue team

## INTRODUCTION

The field of resuscitation has taken two centuries to evolve. Mouth-to-mouth ventilation for drowning victims was recommended by The Paris Academy of Science in 1740. The first documented chest compressions on humans were performed by Dr. Friedrich Maass in 1891. The American Heart Association (AHA) formally endorsed cardiopulmonary resuscitation (CPR) in 1963, and by 1966, the standardized CPR guidelines were adopted for instruction to lay-rescuers. The guidelines have been continually evolving based on scientific evidence and expert consensus. The most recent advanced cardiac life support (ACLS) guidelines were published in 2010 by the AHA and updated in 2015.<sup>[1]</sup> The ACLS training programs have been increasingly concentrating on uniformity of imparting education and in its application. The guidelines have been simplified, and every step described

is crucial in determining outcome. This study was aimed at evaluating how much of this education actually gets translated into practice and its impact on outcome.

## PATIENTS AND METHODS

This clinical audit was done by reviewing the Code Blue records from 2014 to 2015 at Lourdes Hospital, Pachalam, Kochi. It was a retrospective study. The records of witnessed cardiac arrests among in-hospital patients aged 30–80 years

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were scrutinized. Records of patients in whom the relatives were not willing for continuation of treatment after attainment for successful return of spontaneous circulation (ROSC) and those patients who were pregnant at the time of death were excluded.

### Study design

The records were screened to see whether ACLS guidelines were followed, how many had ROSC, and of those who achieved ROSC, how many survived to discharge [Figure 1]. The data were compared to look for any differences in outcome among those patients, in whom the ACLS guidelines (2010) were followed and in those in whom they were not.

Data were collected from Code Blue flowcharts that were maintained in the hospital during the period 2014–2015. The chart includes demographic data such as age and gender, whether the resuscitation team looked for response, breathing and pulse, initial rhythm, whether defibrillation used, method of ventilation, whether ROSC was achieved, and whether he/she survived to discharge.

Data were entered into Microsoft Excel and then drafted into SPSS (IBM, USA) software. Frequency tables were created using the SPSS software version 24. Chi-square test was used to assess if any significant relationship existed between the resuscitations, in which ACLS protocol was followed and in those in which it was not followed.

## RESULTS

A total of 150 patient files were studied. The demographic data are given in Table 1.

The most common arrest rhythm identified was pulseless electrical activity, followed by asystole. Ventricular tachycardia (VT) and ventricular fibrillation (VF) constituted only 3.3 and 4%, respectively [Table 2]. Seventy-four percent of them did not require defibrillation as they did not have any shockable rhythm. Twenty-five percent were resuscitated in <20 min. Out of 88 (58.7%) patients in whom ACLS protocol was strictly followed, 59 had ROSC. The remaining 41.3% had some deviation from the ACLS algorithms [Table 3]. The most common deviation was seen to

**Table 1: Age and gender distribution of the study population**

	Frequency
Age in years	
31-40	9
41-50	22
51-60	31
61-70	46
71-80	42
Gender	
Male	104
Female	46

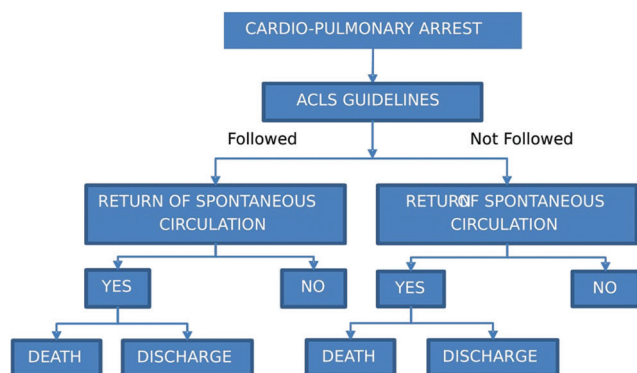
**Table 2: Details of resuscitation**

Parameter	Number of cases
Initial response	
Response activated	146
Palpated for pulse	40
Chest compression	141
Breathing pattern	
Apnoeic	119
Agonal	31
Ventilation	
Bag and mask only	54
Bag and mask with endotracheal intubation	96
First identified arrest rhythm	
Pulseless electrical activity	106
Asystole	41
Ventricular fibrillation/ventricular tachycardia	11
Need for defibrillation during the resuscitation	
No defibrillation	111
Defibrillation ×1	11
Defibrillation ×2	13
>2 defibrillations	15
Total duration of resuscitation	
<5 min	13
6-10 min	25
11-15 min	12
16-20 min	13
21-25 min	14
26-30 min	21
>30 min	52
Final outcome	
Expired	127
Discharged	23

**Table 3: Comparison of return of spontaneous circulation with adherence to algorithm**

	ROSC	No ROSC	Total
Algorithm followed	59	29	88
Algorithm not followed	21	41	62
Total	80	70	150

Chi-square test  $P < 0.0001$ . ROSC: Return of spontaneous circulation



**Figure 1: Study design**

be administration of inappropriate drugs, followed by usage of drugs less than indicated (11.3%) or too many (8%) [Table 4]. Inappropriate shock was administered in 1.3%. Although 80 out of 150 (53.3%) patients had ROSC, 28.5% of them were discharged uneventfully [Table 5].

## DISCUSSION

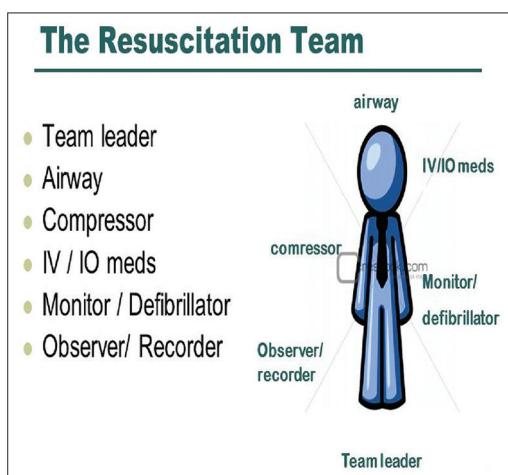
Respiratory arrest is the cessation of breathing. When a patient goes into respiratory arrest, if their respiration is supported promptly, cardiac arrest due to the consequent hypoxia can be averted. However, if oxygenation is not adequate, they may suffer brain damage or cardiac arrest within minutes.<sup>[2]</sup> Cardiac arrest is often due to electrical malfunction resulting in VF or VT resulting in loss of pulse.<sup>[3]</sup> Since blood flow ceases to all organs including vital organs, respiration also ceases and eventually leads to death. CPR is an emergency procedure that combines chest compression and artificial ventilation to manually ensure blood flow and oxygenation, thus preserving organ function. At the same time, efforts are made to restore spontaneous circulation and breathing in a person who is in cardiac arrest.<sup>[4]</sup>

**Table 4: Parameters not adhered to in the advanced cardiac life support 2010 resuscitation algorithms**

	Frequency
Inappropriate drugs	31
Too less drugs	17
Too many drugs	13
Inappropriate shock	1

**Table 5: Survival to discharge in those patients who had return of spontaneous circulation**

	n (%)
Expired	57 (71.5)
Discharged	23 (28.5)



**Figure 2:** Resuscitation team

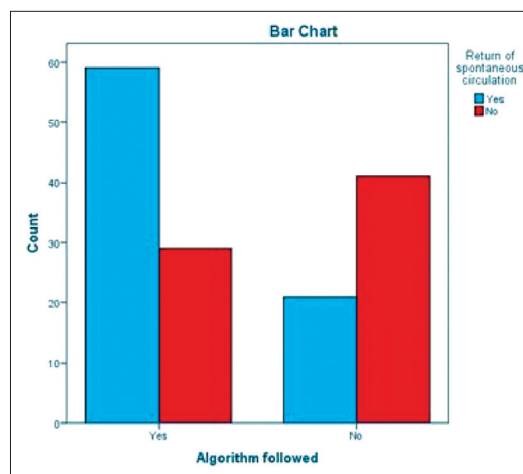
CPR, especially if performed appropriately and in the first few minutes of cardiac arrest, can double or triple a person’s chance of survival.<sup>[5]</sup> The 2010 AHA Guidelines for CPR and Emergency Cardiovascular Care (ECC) was developed by the 2010 International Consensus on ECC and CPR Science with Treatment Recommendations Conference. AHA Guidelines Latest Update for CPR and ECC was published in 2015.<sup>[6]</sup>

CPR should be initiated immediately on an unconscious and pulseless patient. Steps of Basic CPR include assessing unconsciousness, calling for help, confirmation of the absence of breathing and pulse, followed by the initiation of cardiac compressions and ventilation. As soon as the automated external defibrillator is available, the presence of shockable rhythms (VF and pulseless VT) must be looked for so that they can be shocked and hope to attain ROSC. In addition, CPR should be resumed immediately after a defibrillatory shock until a pulsatile state is established.<sup>[7]</sup>

## Code Blue

It is an emergency situation announced in a hospital or institution, announced when a patient is in cardiopulmonary arrest and a designated team of responders (called the “code blue team”) [Figure 2] rush to the specific location and begin immediate resuscitative efforts.<sup>[8]</sup> The team is trained to follow resuscitation guidelines, and the tasks are divided among team members. They must maintain their training and work collectively in an organized manner for the best possible outcome.<sup>[9]</sup>

Survival rates and neurologic outcomes are poor for patients with cardiac arrests. Early CPR, early defibrillation, recommended drugs, and appropriate implementation of postcardiac arrest care lead to improved survival and neurologic outcomes. Studies have shown that, in cardiac arrest without CPR delivery, survival falls by 10%–15% for each minute of delay.



**Figure 3:** Comparison of return of spontaneous circulation in those patients where the algorithm was followed to those where the algorithm was not followed

The AHA-sponsored National Registry of CPR conducts prospective, multisite, observational study of in-hospital resuscitation. About 14,720 cardiac arrests between the period of January 1, 2000, and June 30, 2002, occurred in adults at the 207 participating hospitals. Overall, 44% of adult in-hospital cardiac arrest victims had an ROSC; 17% survived to hospital discharge.<sup>[10]</sup>

Similar results were seen by McEvoy *et al.*<sup>[11-14]</sup> The immediate success of resuscitation efforts for all patients was better with relation to other studies, but as the aim of the study was to assess adherence and outcome in those patients, the study of other factors contributing to the success of CPR was beyond scope.

The incidence of VT and VF was low. One possible explanation could be that arrhythmias occur less commonly in in-hospital arrests, which was only included in this study. Arrhythmias may be higher in out-of-hospital arrests. That may be the reason that our study had lower incidence of arrhythmias compared with other studies.

The most common error is the use of inappropriate drugs. Three possible reasons may explain this. First, the lack of knowledge of the appropriate drugs during CPR as advised in the ACLS protocol. Considering that all members of our Code Blue team are ACLS trained, this is less likely. Second, lack of belief in the ACLS protocols may cause this. Third, inappropriate drugs may be used as a measure of desperation. This decreases the chances of survival for the patient. It must be regularly reinforced to the Code Blue team that just following the algorithm is more likely to result in ROSC than unwarranted drugs.

The survival-to-discharge ratio is still low. This is similar to other studies. This shows that the potential of a patient to get discharged also depends on other factors such as underlying disease process and comorbidities which eventually decide the final outcome. However, proper ACLS followed resuscitation raises immediate survival and gives a chance to reverse the disease process [Tables 3 and 5].

There was a significant increase in ROSC with ACLS protocol, followed by resuscitations in comparison with those resuscitations where ROSC was not followed [Figure 3]. This has also been shown in other studies consistently. It emphasizes the need to regularly reinforce ACLS protocols among the Code Blue members and strict monitoring.

## CONCLUSION

Regular re-enforcement ACLS protocols among the Code Blue members are essential. It must be communicated to the Code Blue team that following the ACLS algorithm is more likely to result in ROSC. Strict monitoring of the performance of the Code Blue team is needed.

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## Conflicts of interest

There are no conflicts of interest.

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