Original article

Long term survival in patients who sustained in-hospital cardiac arrest

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Abstract

Introduction: Cardiopulmonary resuscitation can be termed successful only if the victim survives to hospital discharge and returns to a reasonable quality of life. **Aim**: The aim of this study was to determine long term survival and quality of life of patients who sustained in-hospital cardiac arrest. **Patients and Methods**: This was a prospective interventional study of 1955 patients who sustained in- hospital cardiac arrest at a tertiary hospital in India. Adult patients who sustained cardiac arrest in the hospital were included in the study and patients who were < 18 years of age, cardiac arrest in operation theatre and patients who were brought in 'near death' state to the hospital were excluded. Parameters were collected during two periods, before and after introduction of Modified Early Warning Score (MEWS). **Results**: In the PreMEWS period, 228 out of 1135 (20%) patients had return of spontaneous circulation (ROSC), of whom 59 survived to discharge (5.19%), 51 patients (4.49%) were alive at 6 months and 45 patients (3.96%) were independent at activities of daily living (ADL). In the PostMEWS period, 202 out of 820 patients (24.6%) had ROSC, of whom 138 patients (16.82%) survived to discharge, 110 were alive at 6 months (13.41%) and 99 (12.07%) were independent at ADL. **Conclusion:** The rate of return of spontaneous circulation, survival to discharge rate, 6 month survival and independence at activities of daily living are all better with the use of modified early warning score.

Keywords: In-hospital cardiac arrest, Modified Early Warning Score, survival to hospital discharge

Introduction

Resuscitation from cardiac arrest is performed with a set of protocols and algorithms available from different learned societies.[1] All medical students and nurses are mandatorily trained in the delivery of cardiopulmonary resuscitation. The outcome of resuscitation is intuitively expected to be better when performed in the hospital as compared to out of hospital cardiac arrest, simply because of easy access to trained personnel and equipment. However, it should also remembered that if a cardiac arrest has to occur in the hospital, the patient's illness must have been severe enough to not respond to treatment given. This study was undertaken to see the effect of introduction of modified early warning score in the hospital on outcomes of CPR. This was done with the surmise that with the implementation of Modified Early Warning Score (MEWS), pre-cardiac arrest situations would be identified and corrected earlier with possible better outcomes.

The MEWS score consists of periodic evaluation of the heart rate, blood pressure, respiratory rate, oxygenation and neurological status. Deviations from the normal values are assigned numbers, which when added up give a score. The response of the treating team is linked to this total score. MEWS is useful in identifying patients who need immediate care and avoid pre-arrest or even cardiac arrest scenario. Its utility as a triage tool has been studied only to a limited extent.[2,3]

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How to cite this article: Nileshwar A, Johnson S. Long term survival in patients who sustained in-hospital cardiac arrest. *Ind J Resp Care* 2016:5(2):739-44.

Cardiopulmonary resuscitation is not useful unless the victim has regained or retained good cerebral function, and also leads a normal or near normal life after discharge from the hospital. The quality of life the patient returns to is important.[4] The reported rate of survival after in-hospital cardiac arrest is 3% to 10%.[5,6] The aim of this study was to determine long term survival in patients who sustained in hospital cardiac arrest.

Patients and Methods

This was a prospective interventional study of 1955 patients who sustained in- hospital cardiac arrest at a tertiary hospital in South India. The study was done from September 2009 to May 2013. Adult patients who sustained cardiac arrest in the hospital were included in the study and patients who were < 18 years of age, cardiac arrest in operation theatre and patients who were brought in 'near death' state to the hospital were excluded. The flow chart 1 shows how the patients were included in the study. Nurses and doctors were trained in the use of MEWS and a trial period of 3 months were given before the data collection.

Statistics

Statistical analysis was performed using statistical software SPSS Version 16.0. Values are expressed in Mean ± SD. Quantitative data were analysed using Paired t test and student t test. Qualitative data were tested using Chi square test. P value of < 0.05 was considered significant.

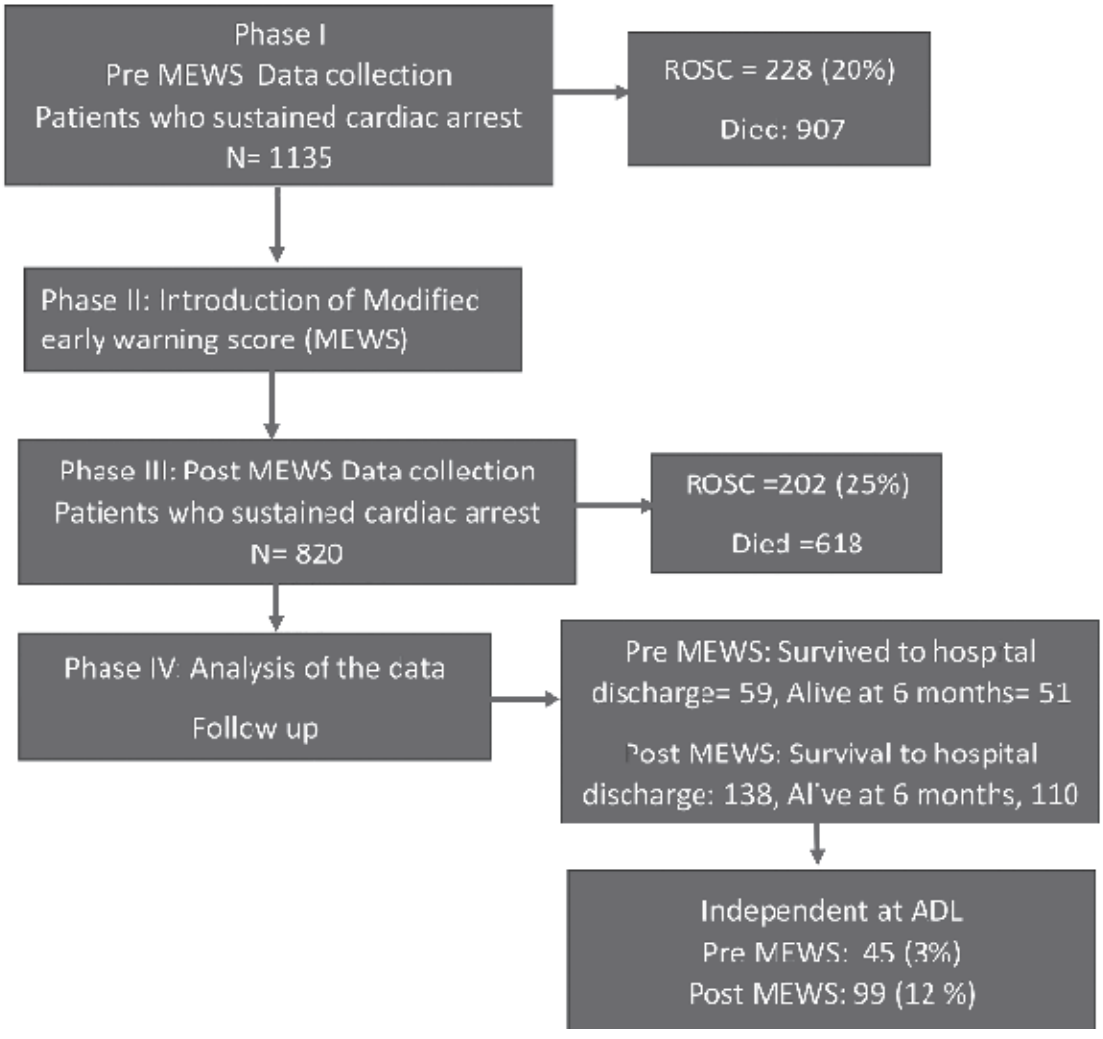

Figure 1: Flow chart

Results

This prospective study was done among 1955 patients who sustained in-hospital cardiac arrest. The demographic details of these patients are given in *Table 1*.

Table 1: Demographic details

	Pre MEWS	Post MEWS
Age in years (Mean ± SD)	52.47 ± 17.27	53.72 ± 16.84
Gender n (%) M/F	770 (67.84%)/365 (32.15%)	557 (68%)/263 (32.07%)

There were 228 out of 1135 patients who had successful resuscitation in the preMEWS. Introduction of MEWS had an impact on the return of spontaneous circulation. It is seen that there is 2.51 (OR) times more chance for patients in the post MEWS to have return of spontaneous circulation - ROSC < 20 min, 1.8 times more chance to have ROSC >20 min < 24 h and 2.08 times more chance for patients in the post MEWS to have ROSC >24 h compared to pre MEWS *(Figure 1)*.

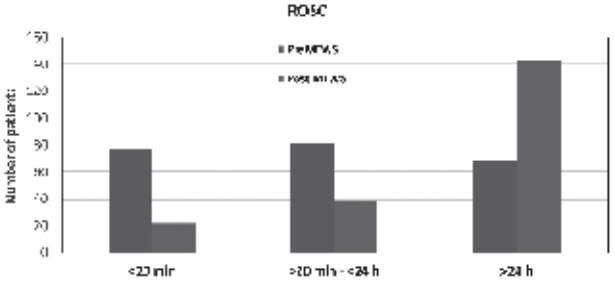

Figure 1: Return of spontaneous circulation

The rhythms noted during cardiac arrest were ventricular fibrillation/ ventricular tachycardia (VF/VT), Non VF/ VT rhythms such as pulseless electrical activity (PEA) and Asystole *(Table 2)*.

Table 2: Initial rhythm

Initial rhythm	Pre MEWS (n = 1135)	Post MEWS (n = 820)
VF/VT	97	194
PEA	284	320
Asystole	754	306

P 0.000

Of the 1135 patients who sustained in-hospital cardiac arrest in the preMEWS period, 59 were alive at discharge, 51 were alive at 6 months and 45 were independent in their daily activities *(Figure 2)*. Six patients were bedridden. Three were lost to followup. Of these, 26 patients were available for complete telephonic interview. In the post-MEWS, out of 138 patients who survived to hospital discharge, by 6 months after discharge, 28 died and 11 were bedridden. 99 patients were independent in daily activities of living of whom 72 patients could be interviewed telephonically.

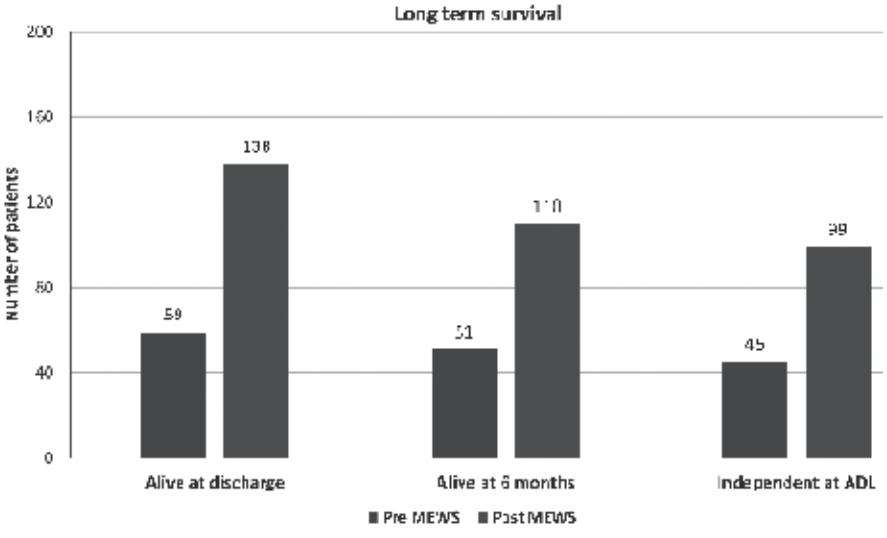

Figure 2: Long term survival

The Cerebral Performance Category (CPC) scale is widely used to assess cerebral function after any insult to the brain.[7] CPC Category 1 and 2, where the patients are conscious; able to work and lead a normal life with minor neurological deficits, if any or with moderate cerebral disability, yet independent ADL, able to do at least part time jobs are regarded as good neurological outcome whereas Category 3 and 4 where there is severe disability, conscious and dependent or unconscious and in a vegetative state are classified as bad outcome.

Table 3 shows the cerebral performance category of patients who survived to hospital discharge in the pre-MEWS and post-MEWS periods.

Table 3: Cerebral performance category

CPC Category	Pre MEWS (n = 59)	Post MEWS (n = 138)	P Value
Category 1	29	72	0.91
Category 2	15	45	0.34
Category 3	10	11	0.10
Category 4	5	10	0.81

The telephonic interview consisted of a series of questions to evaluate the activities of daily living (ADL) *(Table 4)*. Of the 26 patients from the preMEWS period who were available for followup, 19 were able to take bath on their own, had no bladder and bowel disturbances. Movement disorders were present in 10 patients (resting and postural tremors, myoclonus and limb rigidity). None of the 72 patients in the postMEWS period had bowel or bladder disturbances. They also had no movement disorders.

Table 4: Activities of daily living that were evaluated in these patients at 6 months after discharge.

ADL	Pre MEWS (n = 26)	Post MEWS (n = 72)	P value
Bathing	23	72	0.0001
Dressing	23	72	0.0001
Grooming	23	72	0.0001
Walking	23	59	0.02
Washing clothes	10	30	0.09
Toileting	23	72	0.0001
Eating	23	72	0.0001
Using telephone	24	44	0.77
Driving	13	35	0.11
Shopping	26	72	0.0001
Preparing Meals	23	72	0.0001
House work	26	72	0.0001
Taking Medicines	24	44	0.77
Managing finance	18	51	0.01

Out of the eleven patients who were bedridden in the postMEWS period, six were able to recognise people and communicate by words. Hearing was impaired in three of these six participants. Rest of the five participants did not recognise people, had irrelevant speech, tolerated semiliquid food, needed the use of a bedpan for bowel and bladder movements and needed the care of a person at all times. This is the first study that evaluated CPC and ADL pre and post introduction of MEWS.

Discussion

The purpose of this study was to evaluate the long term survival in patients who had sustained in hospital cardiac arrest. A total of 1955 patients who sustained cardiac arrest were studied. It is clear from the study that adopting the modified early warning score improves the rate of return of spontaneous circulation after cardiac arrest. The rhythm is more often ventricular fibrillation/ventricular tachycardia (8.5% vs 23.7%) amenable to electrical shock and is more likely reversible. More number of people survived to hospital discharge post MEWS. Nauman Naeem *et al* also came to a similar conclusion where introduction of MEWS resulted in a better survival to hospital discharge.[8]

In our study there was no significant difference in the CPC of the patients who survived to hospital discharge between preMEWS and postMEWs period, there was definitely an improvement in the quality of life as evidenced by their daily activities. The neurological status is definitely better with earlier and more prompt resuscitations. Girotra *et al* have observed that both the survival and neurological outcome of the victims who sustained IHCA have improved over the years.[9]

Pachy G *et al* did a study in OHCA and in that study the survival rate to discharge was 18.6 % -52/279.[10] 27 % were discharged with the use of mechanical ventilation. After 2 years 8 months of cardiac arrest, an interview was done among the survivors or with the family members. Eighteen died before long-term follow-up and six patients improved from the time of discharge. They noted that lower the CPC score, better was the long term survival and ADL (p=0.001). In 30 months' time period after out of hospital cardiac arrest, one third of their patients died. Neurological and functional level improved from that at hospital discharge in many patients. However, some patients with poor neurological status survived for long periods and required continued care. The current study reports 20% death in 6 months' time and functional limitation for many of the participants. This is one of the few researches that evaluated the effectiveness of MEWS in CPC and ADL

Miguel Antonio Moretti a *et al* in their study demonstrated that the presence of a well-trained ACLS team in the hospital improved short and long term outcome of participants with IHCA as the participants will be resuscitated early.[11]

A study by Paul Feingold showed that, overall, the outlook for IHCA survivors-to-discharge is discouraging, mainly within the first 6 months after discharge.[12] They noted that long-term prognosis may vary but is generally not good. Those who are discharged home will quite likely require a caretaker and this is significant in countries where individual families take care of the patients rather than state owned nursing homes.

The limitations of this study are that as the reporting format was new at the initial period of data collection, details of all patients who survived were not available (only 26 out of 45 patients were available) when compared to the post MEWS period. Outcome measures such as ADL was assessed through phone interview calls during the follow up. Neurological evaluation such as CT scan or neurological tests was not conducted as the patient was not interviewed physically at the hospital during the follow up.

Conclusion

The use of modified early warning score results in significant increase in the number of patients presenting with ventricular fibrillation, rate of return of spontaneous circulation, survival to hospital discharge and better quality of life in terms of activities of daily living.

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