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Modified Early Warning Score: Does It Warn Enough

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Abstract

Cardiac arrest occurs when there is a worsening of respiratory, cardiac, and/or cerebral function without appropriate response to abnormal physiological parameters. Early warning score tool have been evolved scientifically and it is a very important tool to determine the changes in the condition of the patient early so that it can be corrected at an earlier stage. Currently MEWS is being practiced by many hospitals across the globe. As per the current literature review MEWS could be used widely and can detect catastrophic medical events such as cardiac arrest quite earlier than it actually happens.

Keywords: Cardiac arrest; Catastrophic; Physiological parameters

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Introduction

Cardiac arrest occurs when there is a worsening of respiratory, cardiac, and/or cerebral function without appropriate response to abnormal physiological parameters. The patient flow is much more than the past in multispecialty hospitals. Each patient admitted in the hospital usually has an observational chart wherein the vital signs of the patient are entered. The scan through this observational chart can actually give an insight to the doctor or the nursing staff about the condition about the patient. In a very busy clinical area, it may happen that these parameters in the vital signs chart go unnoticed by the clinician. An aggregate value or score may give better information than a single vital signs parameter itself. Early warning score is one of that kind which could be diligently used in patients with rapid clinical deteriorations one that happens in cardiac arrest. Return of spontaneous circulation alone is not an indicator of successful resuscitation. Cardiopulmonary resuscitation can only be completely successful if the patient returns to his normal life and has an acceptable quality of life [1].

There are signs and symptoms that follow a critical ailment that warns an awaiting physiological instability. Early warning scores are used to quantify the physiological signs and are profound. Emergency management is required to normalize the physiological parameters and rapid admission to critical care area is done. Monitoring of physiological values in the general ward by early warning score increases the chance of recognizing patients who are not stable and the severely ill. Earlier recognition and treatment will revert the worsening of physiological parameters and enable judicious transfer to the intensive care unit for additional and more intensive support [2].

Early Warning Score

Early warning score tool have been evolved scientifically and it is a very important tool to determine the changes in the condition of the patient early so that it can be corrected at an earlier stage. The parameters used in the scoring system are pulse rate, blood pressure, urine output, AVPU score, and respiratory rate [3]. The final score is obtained by adding up each of the individual scores. Action plan for the score is provided to the staff as given in **Tables 1 and 2**.

Saxon Ridley in his review stated that severe illness or disease is an emergency as the inflammatory response has multiple pathways. When the process is started, it is very difficult to control or eradicate it. Critical illness usually comes with antecedent infection which later leads to organ dysfunction and mortality. If the inflammatory process remains for long time, then it results in increased mortality [4].

Subbe et al. in a prospective cohort study investigated the capability of Modified early warning score to detect patients admitted in the hospital in a very busy clinical ward. This study was performed in a 56 bedded acute ICU and details of 709 patients were recorded. MEWS score greater than five score had an increased chance for death. The Modified Early Warning Score

Table 1 Guide to use modified early warning score (Given as additional doc).

Guide to Mews Scoring System							
Score	**3**	**2**	**1**	**0**	**1**	**2**	**3**
Temperature	-	<35	<36	36.0-37.5	-	>38.0	>39.0
BP systolic (mm Hg)	<80	80-89 or >40 mmHg drop for ormal	90-99 or >20 mmHg drop from normal	100-159	160-179	180-199	≥200
Pulse (beats/min)	<45	45-49	50-59	60-89	90-114	115-129	≥130
Respiratory rate breaths/min	<8	<10	-	10-19	20-24	25-30	>30
SpO2 (%)	<85	85-89	90-93	>94	-	-	-
CNS response (AVPU)	-	New confusion/agitation	-	Alert	Voice	Pain	Unresponsive
Urine output (catheterised)	-	<0.5 ml/kg/h for 2 h	<0.5 ml/kg/h for 1 h	0.5-3 ml/kg/h	>3 ml/kg/h	-	-
Urine output	<500 ml/24 h	<750 ml/24 h	1000-750 ml/24 h	-	-	-	-

(MEWS) could be applied with ease in district level hospital and this can identify patients who are at the verge of deterioration and who require improved levels of patient care in HDU or in the intensive care unit [2]. MEWS is a very easily achievable score which improves the management of surgical patients admitted in the ward.

Gardner Thorpe et al. studied 334 ward patients in a prospective model. The early warning score was documented on all patients and the key end point was transferal to the intensive thoracic unit or to high dependency unit. There were 57 ward patients which comes up to 17% who activated the MEWS algorithm having been scored ≥4. It was observed that patients who had emergencies were at higher chance of triggering the system when compared to the patients who were selected electively. There were sixteen patients who got admitted in the ITU and high dependency unit. This accounts for 5% of the patients. The study reported that the sensitivity of MEWS is 75% and specificity was 83% for those patients who were transferred to the ICUs. This study concluded that MEWS along with a call out algorithm is a beneficial and suitable tool for detecting and managing the patients at risk in surgical patients [5].

Burch et al. evaluated usefulness of MEWS as one of the tools to determine the medical patients who are at risk of in-hospital death and who require admission to the hospital. Results from the study revealed that patients who had higher MEWS died in the hospital (P<0.001). The independent predictors were identified are systolic blood pressure less than 100 mmHg, pulse rate more than or equal to 130 b/min, RR more than or equal to 30 b/min, temperature more than or equal to 35°C and altered level of consciousness. Abnormal systolic blood pressure, respiratory rate more than or equal to 30 breaths/min, and an altered conscious level were considered as independent predictors for In-hospital death. The authors concluded that the five parameter MEWS could be used as a tool which is simple and rapid and can easily determine the patients who may need better care in the ICU or who may be at the verge of a cardiac arrest [3].

Stenhouse et al. developed the early warning score with two aims. They were timely identification of the patients with critical illness or who are at the verge of critical illness, Enable the nursing staff and junior medical doctors to obtain the expert help via the call out or trigger threshold. Early warning score system is potential enough to improve the excellence of patient monitoring, enhance the communication to the expert team, timely transfer to ICU, better medical judging, help in the right assistance for seriously ill patients, provides a better hint of physiological trends, and abnormal physiology, as a prognostic factor of outcome, clinical examination or assessment tool, and as a replacement for clinical judgment [6]. Naeem and Montenegro found that MEWS score introduction helped in the increase of patients with the rhythm as VF/VT, 8.5% vs. 23.7%. Introduction of MEWS resulted in a better survival to hospital discharge and it was statistically significant (5.2% vs. 16.8%). Introduction of MEWS helped in reducing the percentage of in-hospital cardiac arrest by 16% and death had reduced by 11.6%. Early introduction of MEWS might decrease the occurrence of cardiac arrests, mortality and will increase the survival of patients who are admitted in the HDUs, wards and ICUs. Early detection of the physiological deterioration and the imminent cardiac arrest can allow the help to arrive early or on time which may indirectly prevent the event of cardiac arrest [7].

A study conducted by Bellomo et al. pre and post introduction of ICU based medical emergency team (MET), it was observed that there is a significant decrease in the in hospital cardiac arrest incidence. There was also reduction in death after cardiac arrest (56%) and overall in-hospital mortality (88%) [8].

Buist et al. in their study reported a substantial decrease in the incidence of in-hospital unexpected cardiac arrests. There was a decrease from 3.77 to 2.05 per 1000 hospital admissions and mortality reduced from 77 to 55% after the use of MEWS [9]. Few other studies reported that MEWS significantly reduced the number of in hospital cardiac arrests from 5.21 to 2.39/1000 admissions [10] and the survival to hospital discharge increased from 5% to 16.82% after the introduction of MEWS [1].

Threshold value of MEWS is of importance. A study by Suwanpasu and Sattayasomboon found that MEWS of threshold 4 or more than 4 had a Diagnostic OR of 14.3 with a CI of 12.2 -16.7 when compared to MEWS using a threshold value of 4. They also saw that if the MEWS had a threshold of 5 or more the DOR was 3.28 with a CI of 2.5-4.32 in comparison to using MEWS with a threshold of <5 [11].

Table 2 Guide to use Modified early warning score (continued).

Guide to Mews Scoring System	
Normal	➢ Regular observation
	➢ Maintain frequent observation [2-4 h] of 'high risk' patients
Observe-at risk	➢ Inform nurse-in-charge immediately
	➢ Implement first line treatment
	➢ Increase frequency of observation to 1 hourly (TPR, BP, SpO2)
	➢ Repeat medical review within 4 h-if no improvement seek SENIOR advice or sooner if not improving.
	➢ Continue 2-hourly observations after medical review until return to normal
Warning	➢ Inform nurse-in-charge immediately
	➢ Implement first line treatment
	➢ Commence monitoring (BP, SpO2)
	➢ Increase frequency of observation to 1 hourly until initial medical review
	➢ continue 1 hourly observation until condition stabilised
	➢ Repeat medical review within 2 h-if no improvement seek SENIOR advice or sooner if not improving.
	➢ maintain 2 hourly observations after medical review until return to normal
Urgent	➢ Inform nurse-in-charge immediately
	➢ Implement first line treatment
	➢ Commence monitoring (BP, SpO2, pulse, ECG)
	➢ commence MEWS scoring 15 min until-if no improvement seek
	➢ Maintain 1 hourly observations after medical review until return to normal
	➢ Call Code Blue and/or transfer to ICU if no improvement

Advances in the Monitoring of Early Signs of Cardiac Arrest

There are many advances happening in the field of close monitoring of critically ill patients as well as the in hospital patients. The technology of Earlysense is one of those kinds to monitor the vital signs of patients in hospital beds. EarlySense consists of: (1) A sensor that is placed under the patient's mattress, (2) A bedside monitor, (3) A central display station, and (4) Proprietary analytic software that runs on a PC. EarlySense can monitor up to 40 beds at one time. The sensitivity and specificity of the derived alerts in predicting clinical deterioration were 82% and 67% respectively for HR, and 64% and 81% respectively for RR using threshold alerts. For trend alerts, the sensitivity and specificity of the EarlySense system in predicting clinical deterioration were 78% and 90% respectively for HR, and 100% and 64% respectively for RR. Currently there are no good studies that are strong in design and methods. Feasible substitutes are (1) nurse-led monitoring with a well-executed protocol for calling a RRT and (2) other low-acuity monitors, particularly those that measure blood pressure [12].

A study by Kim et al., found a little different observation about the utility of MEWS. They found that 47% of the patients had low MEWS score 8 h prior to cardiac arrest and that the increase in MEWS was not found to be associated with the in-hospital death [13].

A Cochrane review by McGaughey et al. included two cluster-randomised control trials wherein one study was randomised at hospital level- 23 hospitals in Australia and one at ward level-16 wards in the UK. The primary outcome in the Australian trial-a composite score including incidence of unanticipated cardiac arrests, unpredicted deaths and unexpected ICU admissions revealed no statistical significant difference between control and Medical Emergency Team (MET) hospitals, P value 0.640; adjusted odds ratio (OR) 0.98; 95% Confidence Interval (CI) (0.83 to 1.16). UK-based study found that outreach reduced in-hospital mortality (adjusted OR 0.52; 95% CI 0.32 to 0.85) compared with the control group. They concluded that data from this analysis highlights the mixture and poor methodological quality of most studies examining outreach. The results of the two included studies showed either no evidence of the effectiveness of outreach or a reduction in overall mortality in patients receiving outreach. The lack of evidence on outreach requires extra multicenter RCT's to decide possible effectiveness [14].

Conclusion

Modified early warning score has been developed and validated. Currently MEWS is being practiced by many hospitals across the globe. As per the current literature review MEWS could be used widely and can detect catastrophic medical events such as cardiac arrest quite earlier than it actually happens. Though there are very less data on the specificity of it in terms of the hours prior to the cardiac arrest, it is still worth using it to detect the patients who may have the worsening of physiological parameters especially in multispecialty hospitals with high ratio of nurses to patients.

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