RBTI
2008:20:2:124-127

ORIGINAL ARTICLE

Validation of an Early Warning Score in Pre-Intensive Care Unit*

Validação de um Escore de Alerta Precoce Pré-Admissão na Unidade de Terapia Intensiva

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SUMMARY

BACKGROUND AND OBJECTIVES: Prognosis of patients in the intensive care unit (ICU) has a relation with their severity just before admission. The Modified Early Warning Score (MEWS) was used to evaluate the severe condition of patients 12, 24 and 72 hours before admission in the ICU, assess the most prevalent parameters and correlate the MEWS before ICU with the outcome (survival versus death).
METHODS: Retrospective analyses of 65 patients consecutively admitted to the ICU from July to October, 2006 evaluating the physiological parameters 72 hours prior to admission.
RESULTS: APACHE II mean was 22.2 ± 7.9 points, mortality was 54.6% and standardized mortality ratio means was 1.24. MEWS means were 3.7 ± 0.2; 4.0 ± 0.2 and 5.1 ± 0.2 points, calculated 72, 48 and 24 hours previous to ICU admission, respectively. An increasing percentage of patients with MEWS > 3 points within 72, 48 and 24 hours before admission – 43.8%, 59.4% and 73.4%, respectively was recorded. Among the included physiological parameters respiratory rate contributed the most to the MEWS. Highest mortality was found in patients with MEWS > 3 points already found 72 hours before admission. Patients who died presented with a significant increase in the MEWS 24 hours prior to admission to the ICU (in relation to the MEWS recorded 72 hours before) but the situation was not identified in survivors.
CONCLUSIONS: MEWS closely identified the severity of patients admitted to the ICU, suggesting that it can be a reliable score, useful in the situations preceding the ICU.
Key Words: critical care, epidemiology, mortality prediction, scoring system

RESUMO

JUSTIFICATICA E OBJETIVOS: O prognóstico dos pacientes admitidos em unidade de terapia intensiva (UTI) tem relação com sua gravidade nos momentos que precedem a internação. O objetivo deste estudo foi avaliar a gravidade dos pacientes 12, 24 e 72h antes da admissão na UTI, bem como qual o parâmetro mais prevalente nesses pacientes e correlacionar o *Modified Early Warning Score* (MEWS) no pré-UTI com o desfecho (sobrevivência *versus* óbito), respectivo.
MÉTODO: Análise retrospectiva de 65 pacientes, nas 72 horas que antecederam a admissão na UTI, no período de julho a outubro de 2006.
RESULTADOS: O APACHE II médio foi 22,2 ± 7,9 pontos, a mortalidade real de 54,6% e a taxa de mortalidade padronizada foi 1,24. O MEWS médio foi 3,7 ± 0,2; 4,0 ± 0,2 e 5,1 ± 0,2 pontos, calculado 72, 48 e 24h antes da admissão na UTI, respectivamente. Registrou-se um per-

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Submitted on October 31, 2007
Acceppted for publication on March 25, 2008

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centual crescente de pacientes com MEWS > 3 pontos nas 72, 48 e 24h antes da admissão – 43,8%, 59,4% e 73,4%, respectivamente. Dentre os parâmetros fisiológicos, a freqüência respiratória foi a que mais contribuiu para a pontuação do MEWS. A mortalidade foi maior entre os pacientes com MEWS > 3 pontos já 72 horas antes da admissão. Entre os pacientes que faleceram, verificou-se um aumento significativo no MEWS médio, 24 horas antes da admissão à UTI (em relação ao registrado, 72 horas antes), fato não identificado nos sobreviventes.
CONCLUSÕES: O MEWS identificou com fidelidade a gravidade dos pacientes admitidos na UTI, sugerindo ser um escore confiável à aplicação nas instancias que precedem a UTI.
Unitermos: cuidados intensivos, epidemiologia, escore de gravidade, predição de mortalidade

INTRODUCTIION

Patients admitted to an intensive care unit (ICU) have unforeseeable morbidity/mortality and usually present signs of warning a few days prior to admission[1,2]. Physiological changes that reflect clinical deterioration may be an early warning of truly or potentially critical patients that require special monitoring in the wards[3]. A delay in the identification of such patients implies a later intervention and thus higher hospital mortality[4].
Some studies have shown that early warning scores used at the bedside are a simple tool for identifying patients in imminent risk of death, who thereby are granted admission to the ICU[3,5-7]. Among the different versions, the Modified Early Warning Score (MEWS)[5,8] has merited special attention. This score is based upon monitoring of easily accessible physiological parameters - systolic blood pressure, heart rate, respiratory rate, body temperature and level of consciousness (Table 1). A study using MEWS identified greater severity in patients with an end score above 5 points[5].
The objective of this study was to evaluate the severity of patients 12, 24 and 72 hours before admission to the ICU to identify which was the most prevalent parameter in these patients and to correlate MEWS Pre-ICU with the respective outcome (survival versus death).

METHODS

This is a study of 65 patients admitted to the ICU for adults at the Hospital Universitário Walter Cantídio (HUWC) of the Federal University of Ceará, from July 1 to October 31, 2006. Retrospectively, only patients who had already been in the wards of HUWC for more than 72 h, were surveyed. Clinical data for setting up of MEWS were collected by review of the medical charts after approval by the Ethics in Research Committee. Severity of the patients was assessed using the APACHE II (score and estimated mortality) and the mortality ratio was standardized according to the relation between actual mortality and the mean of the predicted mortality. It should be noted that, the HUWC did not have its own emergency unity at that time, essentially caring for patients with selective and chronic diseases in its clinics, some of them with earlier admissions.
The GraphPad Prism for Windows (version 4.0) program was used for statistical analysis. Mean and standard deviation were assessed for continuous variables with normal distribution, while distribution of ratios was assessed for discrete variables. Analysis of Variance (ANOVA) followed by the Bonferroni test was used. Survival of the groups was estimated by the Kaplan-Meyer method followed by the Gehan-Breslow test. The level of significance adopted was of 5% ($\alpha = 0.05$).

RESULTS

Women comprised 60% of the included population and mean age was 51.4 ± 20.6 years. Average time of ICU stay was of 6.3 ± 7.2 days, the mean APACHE II 22.2 ± 7.9 points, actual mortality was of 54.6% and the mortality ratio was standardized at 1.24.
During the observation period the MEWS mean was of 3.7 ± 0.2; 4.0 ± 0.2 and 5.1 ± 0.2 points, calculated respectively 72, 48 and 24h prior to admission at the

Table 1 – Modified Early Warning Score (MEWS).

	Scores						
	3	2	1	0	1	2	3
Heart rate (bpm)		< 40	41-50	51-100	101-110	111-120	> 120
Respiratory rate (rpm)		< 9		0-14	15-20	21-29	> 30
Systolic blood pressure (mmHg)	< 70	71-80	81-100	101-199		> 200	
Level of consciousness				Alert	Confused	Response to pain	Unconscious
Temperature (°C)		< 35		35.1-37.8		> 37.8	

ICU. A growing percentage of patients with MEWS > 3 points at the 72, 48 and 24h prior to admission – 43.8%, 59.4% and 73.4%, respectively was recorded.
Distribution of the altered physiological parameters is shown in figure 1. Respiratory rate was the reading that contributed the most to the MEWS scoring.

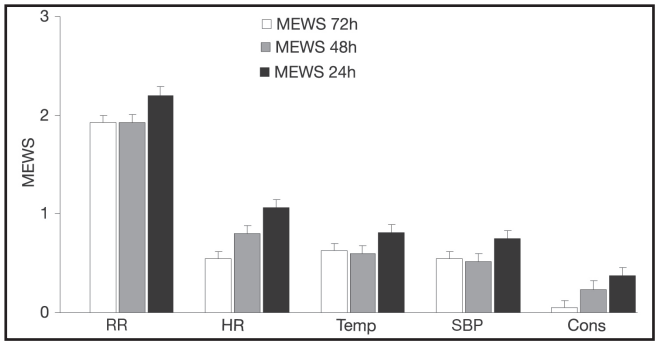

Figure 1 – Distribution of the Altered Parameters in the 72, 48 and 24h Preceding ICU Admission.
RR = respiratory rate; HR = heart rate; Temp = temperature; SBP = systolic blood pressure; Cons = level of consciousness. Values expressed in Mean ± SD.

Among patients who 72 hours prior to admission to the ICU already had a MEWS > 3 points mortality was of 43.1%, whereas among those that had this score only 48 to 24h before, it was of 33.6% and 23.5% respectively. Kaplan-Meyer curves (Figure 2) of patients with changed MEWS 24 and 72 hours before admission showed significant differences in survival, with a marked decrease in patients with earlier altered values ($p < 0.05$).

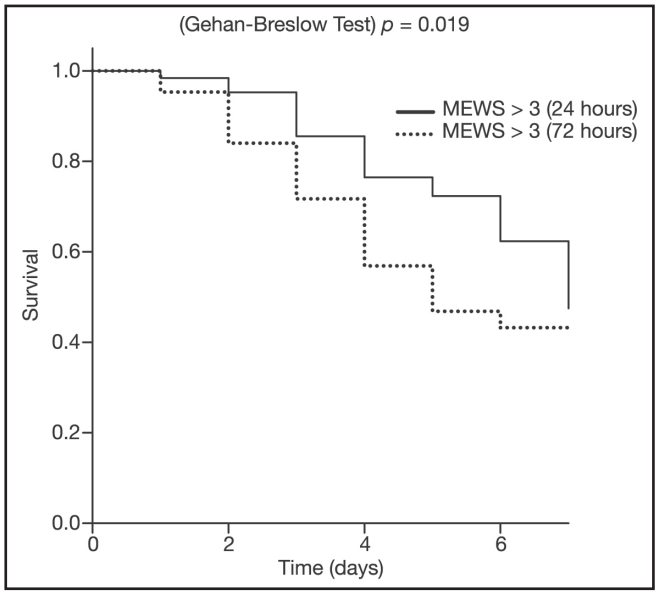

Figure 2 – Comparison between MEWS 24 and 72 Hours prior to ICU and Survival.

Among patients who died, a significant increase of mean MEWS was noted 24 hours prior to admission to the ICU (in relation to that recorded 72 hours before) (5.6 ± 0.3 versus 3.9 ± 0.3 points). Such a fact was not identified in the survivors (Figure 3) ($p < 0.05$).

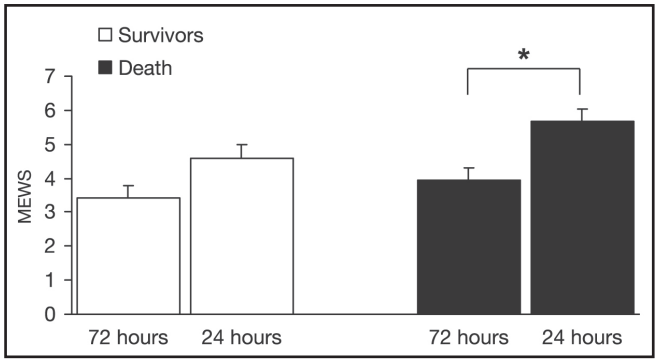

Figure 3 – Relation between Increase of MEWS prior to ICU Admission and Risk of Death.
Values expressed in Mean ± SD; *p < 0.05.

DISCUSSION

The MEWS is a resourceful tool, based upon physiological parameters, capable of warning physicians (and other members of the assisting teams) about risk-patients[3]. Former studies have shown the positive relation between the magnitudes of changed scores of critical patients and need for admission to the ICU[3,5]. Severity score systems used after admission to the ICU do not consider the evolution in the days prior to admission, among them the APACHE II assessed 24 hours post-admission.
MEWS can be used in the wards for guidance of a continued follow-up of patients, highlighting that those with changed scores and progressive increase, demand more attention by the team responsible, because there are evidences that early intervention may improve the outcome[9].
This measure may reduce the number of transfers to the ICU[10] and furthermore reduce the severity of patients upon admission.
The current study calls attention to the fact that patients coming from the wards have a high morbidity at the time of admission to the ICU – expressed by the MEWS > 3 points in more than 70% of the population, with an average above 5 points. Such data confirm the close association between critical scores (> 3 points) and the clinical worsening of patients, moreover among those with parameters changed already 72 hours before admission[2,5].
Most of the patients admitted to the ICU, had altered parameters emphasizing that this is the most sensitive data to point out physiological changes since it por-

trays the different aspects of system dysfunction[8,11].

It was proven with statistical significance that dead patients had greater increases of MEWS during the 72 hours preceding admission to the ICU. On the one hand, this may signal a possible lack of awareness of the severity of patients by those assisting them and on the other hand might indicate difficult access to the ICU.

Among limitations of the current study, coming from a single center, the restricted number of patients and the rigor of selection must be mentioned – bringing about a severity bias. Nevertheless, a considerable number of critical patients in the wards of HUWC could be detected, whose needs were poorly cared for and culminated in high mortality after ICU admission. Notwithstanding the outcome, a not so high standardized mortality rate was achieved. Based upon this study, the intention is to actively systemize MEWS in the wards of HUWC, hoping in a future work to improve the present indicators.

MEWS is a simple resource, practiced at the bedside, that can be interpreted by the physician in an effort to identify high risk patients. As such, early and more thorough measures can be promptly enacted to avoid clinical deterioration of these patients because there is a direct relation between presence of a critical score and increasing morbidity/mortality.

REFERENCES

01. Goldhill DR, Sumner A - Outcome of intensive care patients in group of British cares units. Crit Care Med, 1998;26:1337-1345.
02. Sax FL, Charlson ME - Medical patients at high risk for catastrophic deterioration Crit Care Med, 1987;15:510-515.
03. Goldhill DR, McNarry AF, Mandersloot G, et al. A physiologically-based early warning score for ward patients: the association between score and outcome. Anaesthesia, 2005;60:547-553.
04. Goldhill DR, McNarry AF, Hadjianastassiou VG, et al. The longer patients are in hospital before Intensive Care admission the higher their mortality. Intensive Care Med, 2004;30:1908-1913.
05. Subbe CP, Kruger M, Rutherford P, et al. Validation of a modified early warning score in medical admissions. QJM, 2001;94:521-526.
06. Goldhill DR, Worthington L, Mulcahy A, et al. The patient-at-risk team: identifying and managing seriously ill ward patients. Anaesthesia, 1999;54:853-860.
07. Hourihan F, Bishop G, Hillman KM, et al. The medical emergency team; a new strategy to identify and intervene in high-risk patients. Clin Intensive Care, 1995;6:269-279.
08. Subbe CP, Davies RG, Williams E, et al. Effects of introducing the Modified Early Warning score on clinical outcomes, cardio-pulmonary arrest and intensive car utilization in acute medical admissions. Anaesthesia, 2003;58:797-802.
09. Ball C, Kirkby M, Williams S - Effect of the critical care outreach team on patient survival to discharge from hospital and readmission to critical care: non-randomised population based study. BMJ, 2003;327:1014-1017.
10. McQuillan P, Pilkington S, Allan A, et al. Confidential inquiry into quality of care before admission to intensive care. BMJ, 1998;316:1853-1858.
11. Fieselmann JF, Hendryx MS, Helms CM, et al. Respiratory rate predicts cardiopulmonary arrest for internal medicine in patients. J Gen Intern Med, 1993;8:354-360.