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RESEARCH

Modified early warning score: evaluation of trauma patients

Escore de alerta precoce modificado: avaliação de pacientes traumáticos

Puntuación de alerta temprana modificada: evaluación de los pacientes traumáticos

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ABSTRACT

Objective: to identify the severity of patients admitted to an emergency trauma. **Method:** A cross-sectional and retrospective study with 115 trauma patients classified as orange (Manchester System), from June 2013 to July 2014. The data were presented as mean and standard deviation, in addition to the Pearson Chi-square test, One-Way ANOVA and Tukey tests. **Results:** from the sample, 81.7% were male with mean age of 39.46±19.71 years. Higher incidence of major trauma (48.7%) and traumatic brain injury (37.4%). At the end of the outcome and MEWS, most cases that had score 1 to 3 were referred to the operating room and the ICU. **Conclusion:** the start point of MEWS was 2 to 3 points, with significant increase in the severity of the situation of patients seen after 6 hours, and approximately half of the individuals underwent surgery, indicating that the scale is a good predictor of severity.
Descriptors: Emergencies; Emergency Medical Services; Severity of Illness Index; Measures of Association; Exposure; Risk or Outcome.

RESUMO

Objetivo: identificar a gravidade de pacientes admitidos em uma emergência de trauma. **Método:** estudo transversal e retrospectivo realizado com 115 pacientes com trauma, classificados como laranja (Sistema de Manchester), no período de junho de 2013 a julho de 2014. Os dados foram apresentados por média e desvio padrão, além dos testes Qui-quadrado de Pearson, One-Way ANOVA e Tukey. **Resultados:** da amostra, 81,7% eram do sexo masculino, com idade média de 39,46±19,71 anos. Maior ocorrência por trauma maior (48,7%) e traumatismo cranioencefálico (37,4%). No desfecho final e MEWS, a maioria dos casos que obtiveram escore de 1 a 3 foi encaminhada ao centro cirúrgico e à CTI. **Conclusão:** o MEWS inicial foi de 2 a 3 pontos, havendo evolução significativa do Box de gravidade dos pacientes atendidos após 6 horas, sendo que aproximadamente metade dos indivíduos avaliados sofreu intervenção cirúrgica, indicando que a escala é um bom preditivo de gravidade.
Descritores: Emergência; Serviços Médicos de Emergência; Índice de Gravidade de Doença; Medidas de Associação; Exposição; Risco ou Desfecho.

RESUMEN

Objetivo: identificar la gravedad de los pacientes ingresados en un trauma de emergencia. **Método:** estudio transversal y retrospectivo realizado en 115 pacientes con traumatismos clasificados como naranja (sistema de triage Manchester) a partir de junio de 2013 hasta julio de 2014. Los datos se presentaron como media y desviación estándar, y prueba de chi-cuadrado Pearson, ANOVA de una vía y Tukey. **Resultados:** 81,7% de hombres, edad media 39,46±19,71 años. Mayor incidencia de traumatismos graves (48,7%) y lesión cerebral traumática (37,4%). En el resultado final y MEWS (*modified early warning score* - puntuación de alerta temprana modificada), la mayoría de los casos tenían una puntuación de 1-3 y se remitieron a la sala de operaciones y UCI (unidad de cuidados intensivos). **Conclusión:** la puntuación inicial MEWS fue de 2 a 3 puntos, con un aumento importante en la gravedad de la situación de los pacientes atendidos después de 6 horas, y aproximadamente la mitad de los individuos se sometieron a la cirugía, lo que indica que la escala es un buen predictor de la gravedad.
Descriptores: Emergencia; Servicios Médicos de Emergencia; Escala de Gravedad de Lesión; Índice de Severidad de la Enfermedad; Medidas de Asociación; Exposición; Riesgo o Resultado.

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INTRODUCTION

Most critically ill patients who arrive at the emergency can present clear and detectable signs of deterioration in their clinical condition, from those approximately 80% of these signs can be identified 24 hours before the worsening of the event[1].

The lack of information can hinder the ability to recognize those patients at risk of deterioration. However, and although the recognition measures are incomplete, one can identify the clinical aggravation through the Modified Early Warning Score (MEWS).

Several studies have shown this predictive ability of MEWS[2-4] - tool whose purpose is to facilitate communication between nursing and medical teams when the deterioration of the patient's condition becomes visible in the observations chart. In this situation, when necessary, there is the possibility of early intervention to prevent the transfer of patients to intensive care units, and even if the transfer is inevitable to ensure that it occurs without delay[5].

Nowadays, the access of patients to emergency rooms across the country happens at the initial care provided to acute cases, considering the risk assessment and appropriate and necessary action to different diseases[6].

One of the classifications adopted in some emergencies of Brazil is the Manchester Triage System (MTS). However, such classification, when used through the system at the patient's arrival to the emergency is not permanent, since the category defined for these individuals can be changed in seconds, if something has not been identified or their health condition worsening progress. Therefore, professionals should proceed to the reclassification of patients in emergency during their stay in the unit, preventing the deterioration of disease and especially mortality.

In the study conducted by Pinto Junior, Salgado and Chianca (2012) highlighted the need for care in intensive care areas for patients classified at higher risk, but the MTS proved flawed in identifying the deterioration of individuals previously classified[7]. Thus, the objective of this study was to determine whether the MEWS instrument, a secondary assessment in the emergency, may be useful in the early identification of the severity of patients admitted for more than 6 hours, in the case of those initially classified as oranges, in an emergency trauma care in Porto Alegre/RS.

METHODS

Ethical aspects

The research project was submitted to the Research Ethics Committee of the involved institutions and it was approved. All ethical aspects attended the recommendations of the Resolution 466/2012[8].

Design, study site and period

A cross-sectional and retrospective study conducted in the orange Emergency room of the Hospital Cristo Redentor (HCR), which composes the Hospital Group Conceição, in Porto Alegre, Brazil, from June 10th, 2013 to July 11th, 2014.

Population and sample

The population was composed by service bulletins and patients' charts with head trauma, extremity trauma, abdominal and thoracic trauma, and major trauma, of any age, of both genders, ranked by MTS as orange, from June 10th, 2013 to July 11th, 2014. the choice of the period was due to the implementation of the Manchester Triage System, which started on June 10th, 2013 at the institution.

The sample was intentional and consecutive in 115 bulletin board services, classified by type of trauma (traumatic brain injury, extremity trauma, major trauma and abdominal and thoracic trauma) in the period from June 10th, 2013 to July 11th, 2014, registered in the Manchester Triage System protocol. The inclusion criteria were: patients classified by the MTS as orange; hospitalized for trauma of extremities, traumatic brain injury (TBI), major trauma or abdominal and thoracic trauma staying at least 6 hours in emergency. Patients were excluded if they were admitted to the orange room from the red or yellow room and other types of trauma not included in the inclusion selection.

Study protocol

Data collection was performed using a structured questionnaire with five questions filled according to data contained in the patients' charts: a) numerical identification record (questionnaire number); b) date of birth; c) gender; d) reason for the service; e) outcome (hospitalization in the intensive care unit, operating room or death).

The variables assessed in the MEWS which were not included in the initial classification (Manchester) were withdrawn from service bulletin and patients' charts. The Modified Early Warning Score (MEWS) covers five variables with seven possible options - each marked with a score ranging from zero (0) to thirteen (13). Each item can be marked in a different column, that is, it does not need to extend all the criteria of a particular column. The variables assessed were: 1) respiratory rate: measured in breaths per minute (bpm), ranging from less than or equal to eight (two points) to greater than 29 (three points); 2) heart rate: measured in beats per minute (bpm), ranging from less than or equal to 40 (two points) to greater than 129 (three points); 3) Systolic blood pressure (SBP): measured in millimeters of mercury, from less than or equal to 70 (three points) to greater than or equal to 200 (two points); 4) temperature: measured in degrees Celsius from less than or equal to 35 (two points), reaching greater than or equal to 38.6 (two points); 5) level of awareness: evaluated according to the answer or not presented by the patient, assigning zero (alert) to three points (unresponsive). After evaluating all the variables we performed the sum of the points to set the level/degree of the patient's condition. If the result is greater than or equal to four, the physician at the unit should be informed immediately, so that the patient receives proper care in a timely manner[5].

Analysis of results and statistics

The data were stored in an Excel spreadsheet and then transferred to the SPSS Statistics version 17.0 for Windows, for measurement purposes of the results.

Continuous variables with normal distribution were analyzed by descriptive statistics, presented as mean and standard deviation. The chi-square test of Pearson was used to compare the homogeneous variables. The one-way analysis of variance (one-way ANOVA) was also used followed by Tukey test. It was considered significant value of α less than 0.05.

RESULTS

In total, 115 patients' charts were analyzed in this study, without any loss during data collection process. After analyzing the data, it was found that 81.7% of the sample analyzed are male, mean age 39.46±19.71 years. The age group more frequent with 21.7% is 21-30 years old, followed by 20.9% of patients between 31 and 40 years (Table 1).

Regarding the reason why the patients were admitted to the emergency, 48.7% were caused by major trauma, 37.4% by traumatic brain injury (TBI), 11.3% by abdominal and thoracic trauma and 2.6% by extremity trauma, according to Table 1.

Table 1 – Demographic description and reason for hospitalization of patients seen in the orange Emergency room of the *Hospital Cristo Redentor*, Porto Alegre, Rio Grande do Sul, Brazil, 2014

Variable	n (%)
Gender	
Male	94 (81.7)
Female	21 (18.3)
Age group	
1 - 10 years	3 (2.6)
11 - 20 years	16 (13.9)
21 - 30 years	25 (21.7)
31 - 40 years	24 (20.9)
41 - 50 years	18 (15.6)
51 - 60 years	11 (9.6)
61 - 70 years	7 (6.1)
71 - 80 years	6 (5.2)
81 - 90 years	4 (3.5)
91 - 100 years	1 (0.9)
Hospitalization reason	
TBI	43 (37.4)
Extremity trauma	3 (2.6)
Major trauma	56 (48.7)
Abdominal and thoracic trauma	13 (11.3)

Source: Research data (2014).
Note: TBI = Traumatic Brain Injury.

In the evolution of severity (Table 2), comparing the MEWS at admission to 6 hours, there was a statistically significant difference between both groups (p=0.000).

Considering the level of awareness as one of the signs of deterioration (Table 3), it is observed that, when associated to the outcome, it showed a statistically significant (p=0000).

All patients remained for at least six hours in emergency. The outcome and the vital signs of patients were analyzed in two stages: on arrival at the orange room (admission outcome) and after 6 hours of hospitalization (6 hours' outcome). At first, 52.2% of the sample analyzed underwent surgery to stabilize the health status, 28.7% started the hospitalization process in the Intensive Care Unit (ICU) and 18.3% were discharged (table 3). In the second phase, 45.2% of the sample required surgery, and 34.8% were referred to the ICU. Only 2 patients in this period and under the criteria analyzed, died. When comparing the groups (One-Way ANOVA) there was a statistically significant difference (p=0.000) in the evolution of severity of condition of patients treated at the second moment (Table 3).

Table 2 – Evolution, according to MEWS score, the severity of patients seen in the orange Emergency room *Hospital Cristo Redentor*, Porto Alegre, Rio Grande do Sul, Brazil, 2014

MEWS arrival	MEWS 6 hours				*p* value*
	Assessment at each 12 hours	Assessment at each 6 hours	Assessment at 30 minutes to 1 hour; assessment at 1 hour and 4 horas	Intensive care	
To assess every 12 hours (1 point)	5	6	0	0	0.000
To assess every 6 hours (2 - 3 points)	31	27	6	0	
To assess every 30 minutes in 1 hour To assess every 1 hour for 4 hours (4 to 6 points)	5	22	7	3	
Intensive Care (Equal to or greater than 7 points)	0	0	2	1	

Source: Research data (2014).
*Note: *Pearson Chi-square.*

Table 4 shows that, in relation to the outcome at the end and the MEWS, most cases had a score 1 (for the assessment of every 12 hours), they were referred to the operating room and ICU before completing this period (p=0.000). Those who had a score 2 to 3 points should be assessed every six hours, after this period, they were referred to the operating room and admission to ICU, mostly.

When the type of trauma was compared with age, there was no difference between the groups (p=0.165). Regarding the outcome, it can be seen that the extremities trauma (p=0.000) and major trauma (p=-0.036) were statistically influenced when compared between the groups (p=0.012) (Table 5).

Table 3 – Comparison of admission outcome and after 6 hours of patients seen in the orange Emergency room *Hospital Cristo Redentor*, Porto Alegre, Rio Grande do Sul, Brazil, 2014

Variable	n (%)	*P* value**
Outcome at admission		
Hospitalization ICU	33 (28.7)	
Operating room	60 (52.2)	
Death	01 (0.9)	
Hospital discharge	21 (18.3)	
		0,000
Outcome at 6 hours		
Hospitalization ICU	40 (34.8)	
Operating room	52 (45.2)	
Death	02 (1.7)	
Hospital discharge	21 (18.3)	

Data: Research data (2014).
*Note: **ANOVA One-Way; ICU: Intensive Care Unit.*

Table 4 – MEWS Score related to outcome after six hours of the patients seen in the orange Emergency room *Hospital Cristo Redentor*, Porto Alegre, Rio Grande do Sul, Brazil, 2014

MEWS	Outcome				*P* value*
	ICU Hospitalization	Operating room	Death	Hospital discharge	
Assessment every 12 hours (1 point)	12	17	0	12	
Assessment every 6 hours (2 to 3 points)	21	26	0	8	
Assessment every 30 minutes in 1 hour; assessing every 1 hour for 4 hours (4 to 6 points)	7	7	0	1	0.000
Intensive care (Equal to or greater than 7 points)	0	2	2	0	

Source: Research data (2014).
*Note: *Pearson Chi-square; ICU = Intensive Care Unit.*

Table 5 – Association between type of trauma, age and outcome of patients seen in the orange Emergency room *Hospital Cristo Redentor*, Porto Alegre, Rio Grande do Sul, Brazil, 2014

Variable	Trauma type				*P* value***
	TBI n (95%CI)	Trauma of extremity n (95%CI)	Major Trauma n (95%CI)	Abdominal and thoracic Trauma n (95%CI)	
Age	35.92-49.80	-6.68-92.68	32.47-42.28	27.12-45.65	0.165
Outcome	43 (1.64-2.36)	3 (2.00-2.00)	56 (1.79-2.29)	13 (1.34-2.97)	0.012

Source: Research Data (2014).
*Note: *** Levine test; TBI = Traumatic brain injury.*

DISCUSSION

The analysis of 115 patients' charts showed prevalence of males (81.7%), a result that corroborates several studies in which men predominantly appear as the most frequent users in emergency care, and the most affected age group was the group from 20 to 39 years old[9-11].

Major trauma and TBI are the greatest care service in emergency units, however, the trauma of extremities and major trauma were those which had a statistically significant effect (p = 0.012) associated to the outcome.

MEWS is an instrument of ease application at the bedside, which can be interpreted by the team in an attempt to identify high-risk patients[12-14]. This can be seen in the evolution of the severity with statistically significant findings in the evaluation of 6 hours after admission and the outcome (p = 0.000). Thus, one can readily direct early measures to avoid more intensive clinical deterioration in these patients, since there is a direct relationship between the presence of critical score and increasing mortality and morbidity[13].

Out of the five parameters measured by MEWS, three are independent predictors of in-hospital death: respiratory rate, systolic blood pressure and level of consciousness[12]. Changes were found only in the level of consciousness as an aspect of severity predictor, which is a significant fact for patient outcome (p = 0.000). The association between the warning scores and outcome (mortality) is related to other clinical changes[14-15]. In the study published by Subbe et al. (2001), patients who obtained sum equal to or greater than five points in the MEWS score were associated with increased risk of death and admission to ICU[15]. This reinforces the use of MEWS instrument by health professionals already in the "entrance door" (emergency) in order to recognize early clinical deterioration[16].

We demonstrated a statistically significant difference in the evolution of the severity of the situation of patients seen after 6 hours (p = 0.000), with approximately half of the individuals undergoing surgery. Even patients with score 1 (assessment every 12 hours) were referred to the operating room and ICU before completing this period, which demonstrates the resoluteness of the service, as

well as the preparation of the team to carry out an appropriate assessment of trauma victims. Other studies have also shown that the outcomes (death, transfer to ICU) were significantly higher in the group assessed by MEWS[17-18]. In another study, conducted in Asia, the use of MEWS did not perform well in predicting mortality[19]. However, this differs from our reality, since the assessed patients were on average 61 years.

According to Ball, Kirkby and Williams (2003)[20], we can also use the MEWS in the wards with a view to continued patient follow-up, as this instrument shows that those with abnormal scores need further attention by the team responsible and there is evidence that early intervention can improve the prognostic.

One of the constraints of this study factors was the fact that the data was collected in only one public reference hospital of trauma in the city, and the small sample size for the period, due to the adopted inclusion and exclusion criteria and the intrinsic limitations of cross-sectional studies. Although this hospital is one of the references in the metropolitan area for trauma, it does not include the amount of service from other private or public institutions, as well as other reference centers in the region. Although the applicability of MEWS in the emergency service was verified in this context, one cannot generalize its use only based on these results.

The use of MEWS could be an incentive for the rapid identification of critical patients in emergency requiring prompt attention and possible admission to the ICU or referral to the operating room[12]. This advantage is because MEWS was originally developed to detect critical patients at risk of catastrophic deterioration[15]. It also has significant implications as it showed that the admission of critical patients from the emergency directly in ICUs compared to those critically ill patients in a general ward before transfer to the ICU, resulted in lower length of stay in the ICU, and shorter hospital stays.

CONCLUSION

Until the present moment, only a few studies have addressed the use of MEWS in the reclassification of patients in emergency units, as well as a small portion of those describing the practice and effectiveness of the instruments structured to identify patients in clinical deterioration, facts that motivated this research.

The initial MEWS was 2 to 3 points (assessed every 6 hours), with significant increase in the severity of the situation of patients seen after 6 hours, and approximately half of the individuals underwent surgery. Even patients with a score 1 were referred to the operating room and ICU before completing this period. This fact demonstrates the resoluteness of the service, as well as the preparation of the team to carry out a proper assessment for victims of trauma.

This study, despite its limitations, demonstrated the applicability of MEWS in the service in question, since the proposed objectives were met with statistical significance in all tests used. One of its main advantages is the simplicity of application of such an instrument, since only the identification of the patient's vital signs is sufficient to mark the corresponding item on the scale, obtaining then the final score and the consequent frequency of need for new assessments.

It is expected that the results obtained in this research can be used for hospitals, both in emergency services and in ICUs, since it can improve the care in the shortest possible time, maximizing the benefits to the health of patients.

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