Original Article

Early warning score in predicting the severity of acute pancreatitis

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Abstract

Introduction: Acute Pancreatitis is leading causes of morbidity and mortality worldwide. A third of patients develop severe pancreatitis with progressive organ dysfunction caused by systemic inflammatory response syndrome. Early identification of severe pancreatitis is essential for proper care and preventing complications. Various scoring systems have been developed to determine the severity. An ideal prognostic marker would be that is easily measurable, reproducible and cost effective. Early Warning Score is a simple physiological scoring system that can be reliably measured at the patient's bedside. This study was aimed to determine the relationship between early warning score and severity of pancreatitis.

Methods: Patients admitted with diagnosis of acute pancreatitis were included. Early warning score was calculated four hourly for 72 hours. Modified Marshall Score was determined at admission and at 48 hours. Severity of acute pancreatitis as defined by revised Atlanta Classification. EWS was correlated with severity of AP. EWS≥3 for more than 48 hours were regarded as severe pancreatitis and EWS≥3 at any time was regarded as a predictor of severe pancreatitis.

Results: Eighty-six patients were included with 24 (27.9%) with severe pancreatitis. The sensitivity, specificity, positive and negative predictive value of EWS ≥3 persistent for 48 hours or more in predicting severity were 87.5%, 98.38%, 95.45% and 95.31% respectively. Correlation between EWS and severity of pancreatitis was statistically significant.

Conclusion: EWS is useful as an easy and reliable prognostic marker of the evolution and complications of acute pancreatitis.

Keywords: Acute Pancreatitis; Revised Atlanta classification; Early Warning Score

Introduction

Acute Pancreatitis (AP) is leading causes of morbidity and mortality worldwide. Severe pancreatitis may develop in approximately a third of the patients resulting in progressive organ dysfunction which is usually caused by a systemic inflammatory response syndrome (SIRS) and has high morbidity and mortality.[1] Hence, it is very important to determine the severity of the disease to anticipate complications and to manage them.[3] Organ failure is determined by Modified Marshall scoring.[3] Early identification of severe AP is essential for proper care of the disease and avoidance of complications. So various scoring systems have been developed to determine the severity. An ideal prognostic marker would be a single marker which could be measured rapidly and repeatedly at low cost and without discomfort for the patient. Early Warning Score (EWS) is a simple physiological scoring system that can be reliably measured at the patient's bedside.[4] It has its role in wards to evaluate the severity of any disease process and to determine the need of high dependency bed. It can be calculated frequently by any health personnel. Since AP is a dynamic process and systemic inflammatory response syndrome (SIRS) determines the early course of AP, EWS indirectly measures SIRS and helps in predicting the severity of the disease.

Methods

Patients admitted in the surgical ward of Tribhuvan University Teaching Hospital with the diagnosis of AP between May 2012 and July 2013 were included. Demographic data including age, sex and etiological factors were recorded. The diagnosis of AP as defined by revised Atlanta classification was taken into consideration.[3] Traumatic pancreatitis, ERCP induced pancreatitis, those with doubtful diagnosis, age<16 years, patients initially managed at other centers were excluded. Informed consent was taken. Blood pressure, pulse, respiratory rate, temperature, neurological status and urine output were recorded four hourly and as per necessary from the time of admission till 72 hours. EWS was calculated four hourly for 72 hours. It consists of six parameters- pulse rate, systolic blood pressure, respiratory rate, temperature, level of consciousness and urine output (Table 1).[4]

Modified Marshall Score was determined at admission and at 48 hours and at any point of time after admission as per need of the patient. Severity of acute pancreatitis was classified as defined by revised Atlanta Classification.[3] Data were collected in a pro forma. Approval was taken from institutional review board. The data were analyzed using Statistical Package for Social Sciences (SPSS). Sensitivity, specificity and positive and negative predictive value of EWS were determined in relation to severity of acute pancreatitis. Correlation between EWS and severity was made using Spearman's correlation test. P value <0.05 was considered clinically significant.

Results

Eighty-six patients of acute AP were included in the study. The mean age of the patients was 47.07±17.06 years (16-84 years). AP was common in 40-49 years of age group. Among them, 48 (55.8%), 14 (16.3%) and 24 (27.9%) patients had mild, moderately severe and severe pancreatitis respectively according to revised Atlanta classification. Severe and moderately severe group had more patients with higher mean age (52.96 and 54.4 years respectively) compared to mild (41.98 years). Males and females were equal in number. Males had more severe course of the disease than females (p value<0.05). Biliary cause was the most common cause (53.5%) followed by alcohol(24.5%). There was no significant association between etiology and severity of the disease (p >0.05). Severe cases had significantly longer mean duration of stay (9 days) in comparison to mild (4.33 days) and moderately

Table 1. Early Warning Score

Score	3	2	1	0	1	2	3
Heart Rate ((beats/min)		<40	41-50	51-100	101-110	111-129	>130
Systolic blood pressure (mmHg)	<70	71-80	81-100	101-199		>200	
Respiratory rate (/min)		<9		9-14	15-20	21-30	>30
Temperature (°C)		<=35		35.1-37.5	>37.5		
Level of consciousness				Alert	Verbal response	Pain response	Unconscious
Urine output	Nil	<20 ml/ 2 hours	20-50 ml/ 2 hours	>50 ml/ 2 hours			

Significant>=3

severe (4.79 days). Those having EWS≥3 for 48 hours or more were regarded as severe pancreatitis and EWS≥3 at any time was regarded as a predictor of severe pancreatitis. According to EWS, 22 (25.58%) were severe. EWS ≥ 3 On Day 1, 2 and 3 predicted severity of pancreatitis in 31(36.6%), 22 (25.58%) and 18 (20.93%) respectively.

The sensitivity and specificity of EWS ≥3 On 1st, 2nd and 3rd day in predicting severity were 92% and 85%; 88% and 98%; and 75% and 100% respectively (**Table 2).** Likewise, the sensitivity, specificity, PPV and NPV of EWS ≥3 persistent for 48 hours or more in predicting severity were 87.5%, 98.38%, 95.45% and 95.31% respectively. When Receiver Operating Characteristics (ROC) of EWS for predicting severity were analyzed on Day 1, 2 and 3. EWS on Day 3 had maximum AUC (0.97) followed by Day 2(0.952) and Day 1(0.926) (**Fig. 1)**. Similarly there was significant correlation between EWS persistent for 48 hours and severity of AP ($p <0.05, r=0.770$).

Table 2. Comparison of Sensitivity, Specificity, PPV and NPV of EWS in our study for predicting severity of Acute Pancreatitis

	EWS-24hr	EWS-48hr	EWS-72hr	EWS*
Sensitivity	91.60	87.50	75	87.50
Specificity	85.00	98.30	100	98.38
PPV	71.00	95.45	100	95.45
NPV	96.36	95.35	91.17	95.31

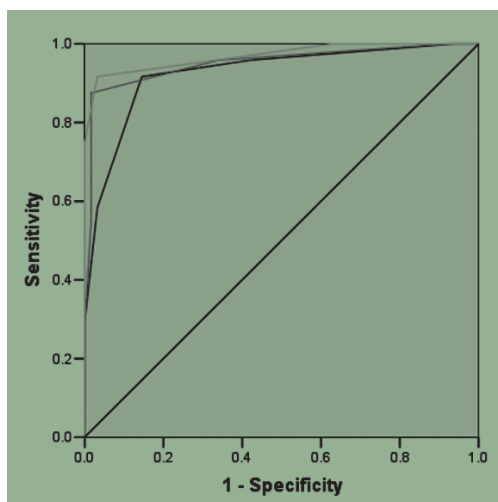*EWS-EWS≥3persistent for 48 hours or more

Figure 1: Receiver Operating Characteristics Curve of EWS on Day 1, 2 and 3

Discussion

AP is a dynamic process such that monitoring should be continuous as complications may occur at any time during its course. It has long been recognized that severe acute pancreatitis almost exclusively develops within the first 72 hours of admission and is characterized by multiple organ dysfunction that may not be clinically apparent on admission.[5] Up to 60 % early mortality occurs within 6 to 10 days from admission and is acknowledged to be SIRS mediated.[6] A second peak of mortality occurs later up to 2 weeks after admission with pancreatitis. Even in this group of late deaths, the presence of organ dysfunction on admission has been shown to be closely linked to late mortality.[7] Hence, early recognition of patients at high risk of mortality is possible within 72 hours of admission. Constant effort has been there to predict its severity to address its complications timely to prevent morbidity and mortality. Most of the single prognostic markers are not available and are very costly if available and cannot be applied frequently. Many prognostic scores like APACHE II are complex to use. Even Ranson's needs 48 hours to predict the severity. As AP has been classified into three broad categories–mild, moderately severe and severe according to severity[3], scoring systems need to be revised as they address only mild or severe form of AP. So, scoring system should be dynamic in itself to predict the complications of AP.

As EWS uses vitals as its variables it has role in predicting severity of any disease process. EWS has been used for many years in wards in most of the hospitals in United Kingdom (UK) to determine the severity of disease such that patients can be labeled critical and can be shifted to high dependency unit timely.[4] In UK, most of the hospitals have their own EWS with some modifications to monitor patients in wards. EWS is an index of SIRS which is the major component of AP leading to complications in its early course. Any health personnel can use this score so that early referral to tertiary centre can be made. Urinary catheterization is the only invasive component of EWS but can be avoided if other components are normal and patient is normally voiding the urine.

In our study, severity increased with the age of the patient. Similar to previous studies, our study showed that males had more severe course of the disease than the females.[8,] [9] However, there was no significant association between etiology and severity of the disease. Other studies have shown varying results regarding the relationship between etiology and severity of AP.[8,9,10]

Our study showed persistent high EWS even up to 72

hours in severe AP whereas low EWS in mild cases and even in most cases of moderately severe pancreatitis from the beginning. This has led to increased sensitivity and specificity of EWS even within 24 hours for predicting severity of AP. Similarly, sensitivity of EWS decreased from first to third day whereas its specificity increased. This is because the disease improves after hospital management in mild and moderate cases. However, the condition may persist or even worsen in severe cases. Similarly, EWS on Day 1, Day 2 and Day 3 have comparable ROC area under the curve showing that EWS is a reliable tool in predicting severity of AP from the time of admission (**Figure 1**).

Many studies have been carried out about its role in monitoring ward patients. EWS has been observed to be 75% sensitive and 83% specific for surgical-in-patients who required transfer to high dependency unit and has been recommended to be implemented for all surgical in-patients.[12] Moreover, EWS not only gives information about the need for high dependency unit but also about prognosis of the disease process. The prognostic ability of EWS in ICU patients was evaluated and was found to be the predictor of, mortality in the ICU; 30-day mortality and length of stay in the ICU.[13] Similarly, Smith et al[14] delineated that the EWS was an independent predictor of death, resuscitation, unexpected ICU admission, emergency operations, and severe complications in surgical patients. Previous studies have justified the role of EWS in AP, considering the unprecedented nature of the disease process itself.[14-16]

Role of EWS in AP was first studied by Garcea G et al [15-17] and they had clarified the role of EWS as a prognostic marker in predicting the severity of AP.[15-17] They have assessed the relationship of EWS with the outcome of pancreatitis in terms of severity, critical care admission and mortality but severity of AP was categorized into mild and severe according to Atlanta classification. Our study has adopted the original version of EWS where each variable has been recorded at least four hourly and hourly as per patient need.[14] When compared to various scoring systems in different studies, sensitivity and specificity of EWS is comparable or better.[17-1] (**Table 3**).

EWS has an important role in managing AP. However, other scoring systems cannot be replaced by EWS in tertiary care centers where there is good laboratory back up. SIRS is the early component that determines the severity in early course of the disease. EWS if taken accurately can predict the complications and helps in early management. With the revision of classification of severity, our study has categorized severity into three grades-mild, moderately

severe and severe and relationship of EWS has been established with acute severe pancreatitis. This explains high specificity of EWS in predicting severity of AP in our study.

Table 3. Comparison of Sensitivity, Specificity, PPV and NPV for different scoring systems in various studies predicting severity of Acute Pancreatitis

	Sensitivity	Specificity	PPV	NPV
APACHE II (at admission)[18-19]	83.30	68.90	51.70	91.20
APACHE II (at 48 hours)[18-19]	79.40	83.10	64.30	91.40
BALTHAZAR[18-19]	26.70	100.00	100.0	68.60
GLASGOW[18-19]	73.50	71.10	49.00	87.70
RANSON[18-19]	91.20	74.40	57.40	95.70
EWS24 Garcea et al.[14]	81.00	81.60		92.00
EWS24 current study	91.60	85.00	71.00	96.36
EWS* current study	87.50	95.38	95.45	95.30

*EWS≥3 persistent for 48 hours or more

Conclusion

EWS can be used as a prognostic marker of severity of acute pancreatitis. This will not replace the currently accepted scoring systems but still because of its convenience

in assessing repeatedly without any further cost and discomfort at any period of time it can be used routinely in every case of acute pancreatitis to assess its evolution and complications.

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