The role of modified early warning score (MEWS) in prognosis of acute pancreatitis

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ABSTRACT

Objectives: Modified Early Warning Score (MEWS) score is a reliable, safe, instant and inexpensive score, that can be used for prognosticating patients with acute pancreatitis (AP) due to its ability to reflect ongoing changes of the systemic inflammatory response syndrome (SIRS) associated with AP. This study aims to determine an optimal MEWS value in predicting severity in AP and determine its accuracy in doing so.

Methods: Patients diagnosed with AP and admitted to a single institution were analyzed to determine value of MEWS in identifying severe AP. The highest MEWS score (hMEWS) for the day and the mean of all the scores of a given day (mMEWS) were determined for each day. Sensitivity, specificity, negative predictive value (NPV), and positive predictive values (PPV) were calculated for the optimal MEWS values obtained.

Results: Two hundred patients were included. The data suggested that a hMEWS value >2 on day 1 is most accurate in predicting severe AP, with a specificity of 90.8% and positive predictive value of 83.3%. A mMEWS of >1.2 on day 2 was found to be most accurate in

predicting severe AP, with a sensitivity of 81.2%, specificity of 76.6%, PPV of 69.8% and NPV of 85.9%. These were found to be more accurate than previous studies.

Conclusions: MEWS provides a novel, easy, instant, repeatable and reliable prognostic score that is comparable, if not superior to existing scoring systems. Its true value however, may lie in it being used in a resource-limited setting such as primary health care centres.

Key words: MEWS score; Acute pancreatitis; Inflammation; Management.

INTRODUCTION

Acute pancreatitis (AP) is a commonly encountered disease in the emergency triage and is characterized by pancreatic glandular inflammation and architectural disruption associated with autodigestion of the gland. The disease presentation may vary and can be completely benign and resolve fully with good conservative management.[1] On the other hand, it may also present with widespread systemic inflammation involving other organ systems. Approximately 20% develop severe AP (SAP), characterized by persistent organ failure or necrotising pancreatitis (NP) and is associated with a mortality of 15-30%. In comparison, mild AP is associated with only 0-1% mortality.[2] Organ failure is considered the most important determinant for mortality and the key to managing this group of patients is early diagnosis.[3] Several scoring systems are available to determine the severity of AP such as Ranson's score, Glasgow score, APACHE score etc.[4] However, these scoring systems require resource intensive and repeated biochemical analyses and cannot be predictive before 48 hours. The Modified Early Warning Score (MEWS) is a simple bedside scoring index that evaluates the physiological state of the patient based on 6 vital parameters i.e., heart rate, blood pressure, respiratory rate, core body temperature, mental status and urine output.[5] This study aims to determine an optimal MEWS score to detect severe AP and determine its accuracy in doing so.

METHODS

This is an observational study that included patients above 18 years of age with AP admitted to the Department of General Surgery at Kasturba Medical College University Hospital, Manipal, India. The study was conducted between September 2015 to August 2017 and included 200 patients for whom data was collected as per details in a proforma. The sample size was ascertained after discussion with statisticians regarding an adequate sample size that would yield significant results to be tabulated as outcomes. Patients' diagnosed with acute on chronic pancreatitis and patients with recurrent pancreatitis were excluded from the study. Only patient's presenting within 24 hours of onset of symptoms were considered in the study. Patient's vitals were recorded every 6 hours into a MEWS chart (Figure 1) and MEWS scores were calculated for these. This was repeated till 2nd day of admission. Outcome was measured in terms of highest MEWS score of the day (hMEWS) (day 0,1and 2) and mean of total MEWS score (mMEWS) on day 0, 1 and 2 and their correlation with final outcome of the disease. Patient was classified into mild, moderately severe and severe pancreatitis based on the below mentioned modified Atlanta criteria, at the end of their hospital stay. Imaging done during the hospital stay (ultrasound abdomen [USG] and contrast enhanced computed tomography [CECT] of the abdomen) was taken into consideration to assess severity. Statistical analysis was done using SPSS software version 20.0

The following definitions of various types of pancreatitis were considered:

(1) *Mild AP:* features of AP with no evidence of organ failure, local or systemic complications.

(2) *Moderately severe AP:* features of AP with evidence of organ failure that resolves within 48 hours (transient organ failure) and/or local or systemic complications without persistent organ failure.

(3) *Severe AP:* features of AP associated with persistent organ failure lasting more than 48 hours.

Local complications included presence of acute pancreatic fluid collection, pancreatic necrosis, walled off necrosis, splenic and portal vein thrombosis. Systemic complications were defined as exacerbation of a pre-existing comorbidity precipitated by AP.

RESULTS

Two hundred patients with AP were evaluated. The mean age of patients was 37 years with a standard deviation of 10 years. The disease was more commonly encountered in males (90%, n=120) and only 40% females (n=80). Of the 200 patients, 120 patients had mild AP. 65 had moderately severe AP with presence of local complications and/or transient organ failure. The remaining 15 patients had severe AP with persistent organ failure lasting for >48 hours.

Alcohol was found to be the most common etiological factor (n=131). Other causes included gallstones, including bile duct calculi (n=24).Smoking appeared to be a contributory factor along with alcohol consumption. Two cases of hypercalcemia, secondary to hyperparathyroidism from a parathyroid adenoma were also noted. Two patients developed pancreatitis secondary to blunt abdominal injury. One of these patients had pancreatic duct leak that required stenting. One female patient developed pancreatitis secondary to drug intake i.e., methotrexate and steroids. For 21 patients, no identifiable cause for AP could be ascertained.

Based on the above results, a cut off score was generated to identify patients with severe AP. The cut off was determined by calculating the mean of all the available scores in the given categories. Since the number of patients with acute severe pancreatitis was small (n=15) and unlikely to yield a significant result, for the purpose of this study patients with moderately severe and severe pancreatitis were considered as one single group. A cut off score of 2 was determined for hMEWS score of the day, for all 3 days (day 0, 1, 2). The cut off scores of mMEWS for day 0, 1 and 2 were 1.4, 1.4 and 1.2 respectively. Patients who were found to have severe AP and had scores greater than the cut off were considered as the ‘true positives’ and those who had scores lesser or equal to the cut off were considered ‘false negatives’ (Tables

1 and 2). Thence, the specificity, sensitivity, PPV, NPV and accuracy were calculated for each score each day. The data suggested that a hMEWS value >2 on day 1 is most accurate in predicting severe AP, with a specificity of 90.8% and PPV of 83.3%, as reflected by greater area under the ROC curve. With regards to the mMEWS score, a mMEWS >1.2 on day 2 was found to be most accurate in predicting severe AP, with a sensitivity of 81.2%, specificity of 76.6%, PPV of 69.8% and NPV of 85.9% (Tables 3 and 4).

Clinical outcomes could be correlated with severity of pancreatitis as seen by increased length of hospital and ICU stay in patients with severe pancreatitis. Mean number of days of hospital admissions for patients with mild, moderately severe and severe pancreatitis were 7.5, 14.3 and 20.1 days respectively. All patients with severe AP (n=15) and 10 patients with moderately severe AP required ICU care. Mean stay in ICU was 4.5 days in moderately severe group and 11.5 days in patients with severe AP. Of the 200 patients, 2 patients with severe AP succumbed to the disease. Of the remaining 198 patients, 11 patients returned to our hospital (at varying periods during the study period) with recurrent attacks of AP.

DISCUSSION

The primary finding of this study was that the MEWS score is a reliable prognostic indicator for early identification of patients likely to develop severe AP. Also, being easy to perform, it is also a dynamic score, that reflects the persistent SIRS in patients with severe AP. It is a well-known fact that a persistent SIRS at 6 hours or the development of MODS and hypotension despite fluid resuscitation are strong predictors of mortality in AP than biochemical or physiological variables used in alternative scoring systems.[4-7] The frequency of MEWS, which is a minimum of 6 hourly, may also anticipate deterioration sooner than other scoring systems that are performed daily, or on admission and at 48 hours.

One of the earliest studies by Garcea G et al., analyzed the role of early warning score in pancreatitis and postulated that even though the early warning score does not measure

pancreas-specific variables, it could accurately measure the SIRS response in AP.[8] They studied 110 patients with AP and their outcomes and compared their EWS scores with other established scoring systems. It was concluded that EWS is the best predictor of adverse outcome (death, need for necrosectomy and critical care admissions) in the first 24 hours following admission and progressively deteriorating EWS values were associated with increased risk of mortality. It also correlated with the duration of intensive therapy, hospital stay, need for ventilator support and post pancreatitis complications. Based on their analysis, they recommended that a EWS of 3 or greater is an indicator of adverse outcome in AP.[8] Another study by Suppiah et al., assessed the accuracy of MEWS scores in predicting severity of pancreatitis.[5] They studied 142 patients with AP and concluded that a hMEWS score of ≥3 and a mMEWS score >1 is accurate is predicting severe AP. Accuracy of hMEWS >2 and mMEWS >1.4, as determined by our study, was found to be more when compared to other studies (Suppiah et al: sensitivity 77.3-95.5%, specificity 87.5-94.2%, NPV 96-66% and PPV 65.6-94%). Our results showed higher specificity and sensitivity for hMEWS: >2 on day 1 and mMEWS: >1.4 on day 2 when compared to a study by Garcea et al., where sensitivity recorded was between 52-70% and specificity between 70-73%. Sensitivity of our study was found to be greater when compared with BISAP scoring system with comparable specificity, NPV and PPV.[9-13] In comparison to studies assessing APACHE, this study showed higher sensitivity (70-80%) and specificity patterns (70-75%).[14]

There were certain limitations we encountered in our study. Firstly, being a tertiary care centre, a percentage of our study group presented to us after having received conservative management at their local hospital. Also, not many patients with pancreatitis present at onset of pain. Hence true MEWS values since onset (day 0) may not be accurate.

It was also noticed that other comorbidities (known hypertensive, patient with history of COPD, underlying urosepsis) also added to the score without being directly related to

pancreatitis. For *e.g.*, a patient with urosepsis had raised MEWS scores in view of fever and tachycardia, but clinically had only mild AP. Perhaps a study that excludes such cases would probably have greater accuracy of predicting severity of pancreatitis.

CONCLUSION

MEWS score is a reliable, safe, instant and inexpensive score, that can be used easily at all levels of health care for prognosticating patients with AP. We would like to highlight that such a scoring system would be of vital importance especially in facilities with limited resources such as a primary health care unit, as it is more cost-effective and not labour intensive. It can promote earlier referral of patients with an increasing score to a higher centre for further management.

Compliance with Ethical Standards: The study was approved by the medical ethics committee and reported in accordance with the recommendations in the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines for reporting observational studies.

Disclosure: The authors declare no conflicts of interest. No funding was received for this study.

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TABLES:

Table 1: Distribution of patients based on cut-off hMEWS value and severity of disease

Time		**Severity**	
		Severe	Mild
Day 0	hMEWS >2	59	24
	hMEWS ≤2	21	96
		83	117
Day 1	hMEWS >2	55	11
	hMEWS ≤2	25	109
		80	120
Day 2	hMEWS >2	51	14
	hMEWS ≤2	29	106
		80	120

Table 2: Patient distribution as per mMEWS cut-off scores

Time			**Severity**		**Total**
			Severe	Mild	
Day 0	mMEWS	>1.4	61	32	93
		≤1.4	19	88	107
			80	**120**	**200**
Day 1	mMEWS	>1.4	61	28	89
		≤1.4	19	92	111
			80	**120**	**200**
Day 2	mMEWS	>1.2	65	28	93
		≤1.2	15	92	107
			80	**120**	**200**

Table 3: Sensitivity, Specificity, Positive predictive value (PPV) and Negative predictive value (NPV) for each cut-off score

Day	**Sensitivity**	**Specificity**	**PPV**	**NPV**	**Accuracy**
0 (hMEWS >2)	73.75%	80%	71.08%	82.05%	77.5%
1 (hMEWS >2)	68.75%	90.8%	83.3%	81.03%	82%
2 (hMEWS >2)	63.7%	88.3%	78.4%	78.5%	78.5%

Table 4: Sensitivity, Specificity, Positive predictive value (PPV) and Negative predictive value (NPV) for mMEWS on day 0, 1, 2

Day	Sensitivity	Specificity	PPV	NPV	Accuracy
0 (mMEWS >1.4)	76.2%	73.3%	65.5%	82.2%	74.5%
1 (mMEWS >1.4)	76.2%	76.6%	68.5%	82.8%	76.5%
2 (mMEWS >1.2)	81.25%	76.6%	69.8%	85.9%	78.5%

MODIFIED EARLY WARNING SCORE (MEWS)

This should be assessed on all emergency admissions, postoperative patients following major surgery, all patients returning from ICU and any patient that you are concerned about.

Date of admission							Affix patient label here							
Admitting unit														
Ward														
Date														
Time														
HR (beats/min)														
Systolic BP (mm Hg)														
Respiratory rate(bps/min)														
CNS (AVPU)														
Temp (ċ)														
Urine (ml) or (ml/kg/h)														
SpO_2 (%)														
MEWS score														
Doctor called Y/N														

GUIDE TO MEWS SCORING SYSTEM

Score	3	2	1	0	1	2	3
Temperature		< 35	< 36.0	36.0 - 37.5		> 38.0	> 39.0
BP systolic (mm Hg)	< 80	80-89 or > 40 mmHg drop from normal	90-99 or > 20 mmHg drop from normal	100 - 159	160-179	180-199	= 200
Pulse (bpm)	< 45	45-49	50-59	60-89	90-114	115-129	= 130
Respiratory rate (bpm)	< 8	< 10		10 - 19	20-24	25-30	> 30
SpO_2(%)	< 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 hours	< 0.5 ml/kg/h for 1 hour	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				

AVPU: A – Alert; V – Responds to verbal commands; P – Responds to pain only; U - Unresponsive
If the patient has a score of 4 or more call the Unit PG, If no response for 10 min, call the unit staff, if no response and if score increases by 2, call Code Blue.

Figure 1: MEWS chart

**Core body temperatures were recorded orally*