

Original Research Article

Predictive value of modified early warning score in identifying high-risk postoperative patients following abdominal surgery

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ABSTRACT

Background: Modified Early Warning Score (MEWS) is an objective bedside tool for detecting early physiological deterioration and guiding timely intervention. Its predictive role in postoperative general surgical patients, particularly after exploratory laparotomy, is underexplored in developing countries.

Methods: A prospective observational study was conducted from July 2019 to June 2020 in a tertiary care center. A total of 150 patients undergoing exploratory laparotomy were included. MEWS was calculated using six parameters: respiratory rate, systolic blood pressure, heart rate, temperature, urine output and consciousness level at 6-hour intervals postoperatively. Patients were categorized into low-risk (0-2), intermediate-risk (3-4) and high-risk (≥ 5) groups. Outcomes analyzed included ICU admission and mortality.

Results: The mean age of patients was 41.8 years; 50.7% were male. Emergency surgeries constituted 58.7% of cases. $\text{MEWS} \geq 5$ was present in 23.4% of patients. All six deaths occurred in patients with $\text{MEWS} \geq 7$ ($p < 0.001$). ICU admission was significantly associated with higher MEWS. MEWS showed strong predictive accuracy for morbidity and mortality in postoperative patients.

Conclusions: MEWS is a simple, inexpensive and effective tool for early detection of postoperative deterioration and prioritizing ICU transfer. Higher MEWS strongly correlated with mortality and adverse outcomes.

Keywords: Modified early warning score, Exploratory laparotomy, Postoperative complications, Mortality prediction

INTRODUCTION

Early detection of physiological deterioration in postoperative patients is essential for improving surgical outcomes and reducing mortality. Delayed recognition and intervention remain major contributors to poor prognosis in patients admitted to general wards after major surgery.¹ Many in-hospital complications are predictable and preventable through effective monitoring systems.² To address this need, Morgan et al, introduced the Early Warning Score (EWS) in 1997 as a track-and-trigger system to identify early signs of deterioration using basic physiological parameters.³ Over time, the MEWS evolved, incorporating parameters such as

respiratory rate, heart rate, systolic blood pressure, temperature, urine output and neurological status.⁴ MEWS assigns weighted scores to deviations from normal ranges, with higher scores reflecting increasing severity. A threshold score of ≥ 5 usually indicates the need for urgent intervention.⁵ MEWS offers several advantages: it uses routine clinical observations, does not require sophisticated equipment and can be applied by nursing staff and junior doctors. Studies have demonstrated its predictive value in medical and surgical wards, intensive care settings and emergency departments.⁶⁻⁸ The tool aids clinical decision-making, supports early ICU referral and enhances patient safety. Exploratory laparotomy remains a critical surgical

intervention for conditions such as perforation peritonitis, intestinal obstruction and abdominal trauma. These patients often present with systemic instability and are at high risk of postoperative complications, making timely identification of deterioration vital.⁹

Although MEWS is widely studied in developed countries, its application in surgical patients in low-resource settings remains limited. This study aims to evaluate the utility of MEWS in predicting postoperative outcomes among patients undergoing exploratory laparotomy in a tertiary care hospital. Specifically, the objectives are:

To analyze MEWS as a predictor of morbidity and mortality. To assess its role in guiding ICU admissions. To compare findings with similar studies in the literature.

METHODS

Study design and setting

This prospective observational study was conducted in the Department of General Surgery, Government Medical College and New Civil Hospital, over 12 months (July 2019–June 2020). Ethical approval taken from Human Research and ethics committee, GMC Surat.

Sample size

150 patients undergoing exploratory laparotomy, selected by consecutive sampling.

Inclusion criteria

Patients aged >18 years undergoing exploratory laparotomy (elective or emergency).

Exclusion criteria

Patients shifted directly to ICU postoperatively. Those unwilling to participate.

Data collection

Detailed clinical history and demographic data were recorded. Postoperative physiological parameters

(respiratory rate, systolic blood pressure, heart rate, temperature, urine output and AVPU neurological scale) were monitored every 6 hours and MEWS calculated accordingly.

Risk stratification

Low risk: MEWS 0–2, Intermediate risk: MEWS 3–4. High risk: MEWS ≥5.

Outcomes measured

ICU admission requirement. Postoperative mortality.

Statistical analysis

Data were analyzed using SPSS v20. Continuous variables were expressed as mean±SD, categorical data as frequencies and percentages. Chi-square test was applied to assess associations, p value <0.05 was considered statistically significant.

RESULTS

Demographic profile

Mean age was 41.83 years (range: 18–78). Males constituted 50.7%, females 49.3%. Emergency cases accounted for 58.7%, elective for 41.3%.

Modified early warning score distribution

MEWS 0–2 :110 patients (73.3%), MEWS 3–4: 5 patients (3.3%), MEWS ≥5: 35 patients (23.4%).

Mortality

Overall mortality was 4% (6/150). All deaths occurred in patients with MEWS ≥7 (p<0.001). Patients with MEWS 8 had the highest mortality (66.7%).

Intensive care unit admissions

27 patients (18%) required SICU admission. Among these, 25 patients had MEWS ≥5, confirming strong correlation between MEWS and ICU requirement (p<0.001).

Table 1: Modified early warning score.

Score	3	2	1	0	1	2	3
Respiratory rate (/min)		≤8		9-14	15-20	21-29	>29
Heart rate (/min)		≤40	41-50	51-100	101-110	111-129	>129
Systolic BP (mmHg)	≤70	71-80	81-100	101-199		≥200	
Urine output (ml/kg/hr)	Nil	<0.5					
Temperature		≤35	35.1-36	36.1-38	38.1-38.5	≥38.6	
Neurological				Alert	Reacting to voice	Reacting to pain	Unresponsive

Table 2: Age distribution.

Age group (in years)	Number of patients
0-10	0
10-20	5
20-30	36
30-40	39
40-50	29
50-60	25
60-70	15
70-80	1
Total	150

Table 3: Sex distribution.

Sex	Number of patients
Male	76
Female	74

Table 4: Diagnosis.

Diagnosis	Patients (%)
Acute appendicitis	14
Perforation with peritonitis	27.34
Calculous cholecystitis	5.33
GI malignancy	12.67
Intestinal obstruction	8.67
Hernia	5.33
Trauma	5.33
Ruptured liver abscess	2
Renal mass	2
Pheochromocytoma	0.67
Oesophageal stricture	6
Pseudocyst of pancreas	1.33
Bleeding ulcer	1.33
Mesenteric ischemia	0.67
Stoma	3.33
Hydronephrosis	1.33
Chronic pancreatitis	1.33
Hydatid cyst	0.67
Urinary bladder stone	0.67

Table 5: MEW scoring.

MEWS	Number of patients	Number of patients expired	Mortality (%)
0	7	0	0
1	75	0	0
2	28	0	0
3	3	0	0
4	2	0	0
6	3	0	0
7	25	2	8
8	7	4	57

Table 6: ICU admission.

MEWS	Total Patients	ICU	%
0	7	0	0
1	75	0	0
2	28	0	0
3	3	0	0
4	2	0	0
6	3	1	33
7	25	19	76
8	7	7	100

The p value was found to be less than 0.1 and was found to be significant.

Table 7: MEWS mortality predictability.

MEWS	Present study (n=150)			
		Active	Dead	Total
0	Count	7	0	7
	% within SICU/WARD	4.87	0.0	4.67
1	Count	75	0	75
	% within SICU/WARD	52.08	0.0	50.0
2	Count	28	0	28
	% within SICU/WARD	19.44	0.0	18.67
3	Count	3	0	3
	% within SICU/WARD	2.08	0.0	2.0
4	Count	2	0	2
	% within SICU/WARD	1.39	0.0	1.33
6	Count	3	0	3
	% within SICU/WARD	2.08	0.0	2.0
7	Count	23	2	25
	% within SICU/WARD	15.98	33.33	16.66
8	Count	3	4	7
	% within SICU/WARD	2.08	66.67	4.67
Total	Count	144	6	150
	% within SICU/WARD	100.0	100.0	100.0

p<0.1

The p value of MEWS system in detecting deaths of the patients undergoing major surgical procedures was found to be less than 0.1 and was found to be significant.

DISCUSSION

This study demonstrates that MEWS is a significant predictor of adverse outcomes in postoperative surgical patients. Higher MEWS scores were strongly correlated with mortality and ICU admission, similar to findings from previous studies.^{6,12} The study parallels the observations by Somasundaram et al, who reported that patients with MEWS $\geq$ 5 required ICU transfer more frequently.¹² In both studies, mortality was negligible in patients with MEWS<5.

The mortality rate for patients with MEWS $\geq$ 7 in our study was 33.3%, increasing to 66.7% for MEWS.⁸ Somasundaram et al, reported a comparable pattern, with 100% mortality for MEWS.⁸ Gardner-Thorpe et al and Mathukia et al established MEWS as an independent predictor of ICU admission and mortality, recommending its use as a standard postoperative monitoring tool.^{13,14} Our findings reinforce this recommendation, particularly

in low-resource settings where advanced monitoring tools are limited. Respiratory rate and systolic blood pressure, key components of MEWS, have consistently shown strong predictive power for critical illness. Our results align with Kyriacos et al, who emphasized respiratory rate as the earliest marker of deterioration.⁵ Early recognition of deterioration allows timely intervention, reducing delays in ICU transfer and improving survival. In resource-constrained environments, MEWS offers an inexpensive, reliable alternative to invasive monitoring systems.

Strengths include prospective design and standardized MEWS application. Limitations include single-center setting and exclusion of patients transferred directly to ICU, which may underestimate high-risk cases. Implementing MEWS-based protocols can enhance surgical ward surveillance and streamline escalation of care. Mandatory training for staff on MEWS application is essential to maximize its effectiveness.

CONCLUSION

MEWS is an effective, low-cost tool for postoperative risk stratification in surgical patients. Our study demonstrates a clear correlation between increasing MEWS and adverse outcomes, including mortality and ICU admission. Routine use of MEWS in general surgery wards can significantly improve early detection of clinical deterioration, enable timely escalation of care and potentially reduce mortality. Future multicentric studies with larger cohorts are recommended to validate these findings and develop standardized MEWS-based intervention algorithms.

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