Original Article

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Emergency Surgery Score Predicts Morbidity and Mortality in Emergency General Surgery

Tanka Prasad Bohara, Ellina Dangol, Rupesh Mukhia, Mukund Raj Joshi, Kamal Koirala, Dharana Gelal, Rikesh KC
Department of Surgery, KIST Medical College and Teaching Hospital, Imadol, Lalitpur, Nepal

ABSTRACT

Introduction: Emergency surgery (ES) accounts for a substantial number of cases performed by surgeons worldwide. ES is regarded as an independent risk factor for postoperative morbidity and mortality. There are complex scoring systems such as the American Society of Anesthesiologists (ASA) classification, the Physiological and Operative Severity Score for enumeration of Mortality and morbidity (POSSUM), Portsmouth-POSSUM (P-POSSUM) and the Surgical Risk Scale (SRS). scores do not take into consideration high-risk patients undergoing ES and the inherent high risk of ES. Emergency surgery score (ESS) has been derived and validated to predict postoperative morbidity and mortality in ES. We conducted a study to validate the ESS score in patients who underwent emergency general surgery

Methods: Patients who had undergone emergency surgery during the study period were included in the study. ESS score was calculated for included patients. ROC curve was plotted to find the correlation of ESS with 30-day mortality and the occurrence of at least one complication.

Results: Sixty patients were included in the study. ESS predicted mortality and morbidity with area under curve of ROC 1.0 and 0.684 respectively.

Conclusion: ESS predicts postoperative morbidity and mortality in patients undergoing emergency surgery.

Keywords: Emergency surgery; Emergency surgery score; Postoperative morbidity; Postoperative mortality

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Correspondence:
Dr Tanka Prasad Bohara
Associate Professor, Department of Surgery
KIST Medical College and Teaching Hospital
Email: tankaprasad.bohara@gmail.com

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INTRODUCTION

Emergency surgery (ES) accounts for a substantial number of cases performed by surgeons worldwide. The number of ES performed has been increasing.[1] ES is associated with a higher risk of postoperative complications and deaths. ES is regarded as an independent risk factor for postoperative morbidity and mortality.[2,3] Predicting the risk of emergency surgery has the advantages of proper counselling to patient's families about the possible outcome of the ES and identifying patients at higher risk requiring more attention in the postoperative period.[4] Various risk assessment scores are available for predicting the outcome of surgery such as the American Society of Anesthesiologists (ASA) classification, and the Physiological and Operative Severity Score for enumeration of Mortality and morbidity (POSSUM), Portsmouth-POSSUM (P-POSSUM) and the Surgical Risk Scale (SRS).[5,6] But these tools have certain limitations such as these are complex scoring systems, some require intraoperative variables as well as physiologic characteristics. These scores do not take into consideration high-risk patients undergoing ES and inherently high risk of ES.[2,4]

Emergency surgery acuity score which is now popularly known as emergency surgery score(ESS) has been derived and validated which takes into consideration of both patient comorbidities and acuity of disease at presentation.[4] The same score has been validated to predict postoperative complications as well.[7] This score has also been validated in other retrospective studies for the prediction of postoperative morbidity and mortality.[8,9] (8) Recently Kafarani et al have validated this score in a multicentre prospective study.[10]

The ESS includes demographic, co-morbidities and laboratory values to calculate the score. (Table 1).

We conducted a study to validate ESAS scores in patients who underwent emergency general surgery at KIST Medical College Teaching Hospital.

Table 1. Emergency surgery score (ESS)

Variable	Points
Demographics	
Age >60 years	2
White race	1
Transfer from an outside emergency department	1
Transfer from an acute care hospital inpatient facility	1
Comorbidities	
Ascites	1
BMI <20 kg/m^2	1
Disseminated cancer	3
Dyspnea	1
Functional dependence	1
History of COPD	1
Hypertension	1
Steroid use	1
Ventilator requirement within 48hr preoperatively	3
Weight loss >10% in the preceding 6 months	1
Laboratory values	
Albumin <3.0 U/L	1
Alkaline phosphatase >125 U/L	1
Blood urea nitrogen >40mg/dl	1
Creatinine >1.mg/dl	2
International normalized ration >1.5	1
Platelets <150 x 103/ҶL	1
SGOT >40U/L	1
Sodium >145 mg/dl	1
WBC x 10^3/ҶL	
<4.5	1
>15 and ≤ 25	1
>25	2
Maximum score	**29**

BMI: Body mass index; COPD: Chronic Obstructive Pulmonary Disease; SGOT: serum glutamic-oxaloacetic transaminase; WBC: white blood cell.

METHODS

This is a retrospective cross-sectional study. Patients who underwent emergency general surgery at KIST Medical College and Teaching Hospital during the study period from Baishak 2076 to Chaitra 2078 were included in the study. The operation theatre register was screened to identify the patients' names and inpatient numbers of the patient who had undergone ES. Medical records of these patients were retrieved from the medical record department and were studied.

Variable of ESS and outcomes were recorded in proforma. ESS was calculated for each patient, based on the variables and points allocated for each variable as in Table 1. Patients with incomplete records and missing data were excluded from the study, although a recent study has found that ESS performs well in predicting outcomes in emergency general patients even when one or more data elements are missing.[8]

The primary outcome of our study is 30-day mortality and the occurrence of at least one complication. Secondary outcomes are hospital length of stay and postoperative intensive care admission.

Categorical variables were expressed as absolute or relative frequencies and continuous variables were expressed as mean±SD. A t-test will be used to analyze continuous variables, chi-square test or Fischer exact test will be used on categorical variables whichever is appropriate. The correlation between ESS and each outcome of interest was evaluated using the area under the receiver operating characteristic (ROC) curve. a p-value of < 0.05 will be considered statistically significant. SPSS version 20 will be used for the analysis of data.

Table 3. Frequency of Laboratory values

Laboratory values	N= 60(%)
WBC	
<4.5 x 10^9/L	5(8.3%)
15-25 x 10^9/L	15(25%)
>25 x 10^9/L	1(1.7%)
4.5-15 x 10^9/L	39(65%)
Platelets <150 x 10^9/L	0(0%)
INR >1.5	1(1.7%)
Albumin <30gm/L	7(11.7%)
BUN >14.28mmol/L	1(1.7%)
Creatinine >106 mcmol/L	3(5.0%)
SGOT >40 units/L	4(6.7%)
ALP >125 units/L	4(6.7%)
Sodium >145 mmol/L	0(0%)
Lactate >2.9 mmol/L	0(0%)

RESULTS

On screening operation theatre records, 103 emergency operations cases were identified in the study period. Among them, 43 cases had missing data in records or missing medical records and were excluded from the study. Sixty cases were included in the study.

The ESS score data of included patients which includes demographics and comorbidities, frequency of laboratory values and 30-day mortality is shown in table 2, table 3, and table 4 respectively.

Table 2. Frequency of Demographics and comorbidities

Variables	N = 60(%)
Demographics	
Age >60 years	5(8.3%)
Gender	
Male	40(66.7%)
Female	20(33.3%)
Comorbidities	
BMI<20	1(1.7%)
Hypertension	3(5.0%)
Disseminated cancer	1(1.7%)
Steroid use	4(6.7%)
Ventilator requirement within 48 hours preoperatively	4(6.7%)

The morbidity and mortality rate in each ESS score is shown in figure 1 and 2. There were 2 mortalities in the study population which occurred in patients with ESS 9 and 10. (Table 4 and Figure 2). The incidence of primary outcomes and secondary outcomes are shown in Table 4. The most common emergency operation performed during the study period was acute appendicitis. (Table 5). The ROC curves concerning morbidity, mortality and ICU admission are shown in Figures 3.

Area under curve of ROC curve for morbidity, mortality and requirement of ICU admission was 1.0, 0.684 and 0.802 respectively.

Table 4. Primary and secondary outcomes

Primary outcomes	
30-day mortality	2(3.3%)
Occurrence of at least 1 complication	12(20%)
Secondary outcomes	
Hospital length of stay	4.4833±0.306
Post-operative ICU admission	1.3±0.3065

Table 5.Diagnosis of patients

Diagnosis	**Frequency (%)**
Acute appendicitis	42 (70%)
Peritonitis	
Appendicular perforation	5(8.3%)
DU Perforation	6(10%)
Distal ileum perforation	1(1.6%)
Blunt abdominal trauma	3(5%)
Acute intestinal obstruction	2(3.33%)
Obstructed hernia	1(1.6%)

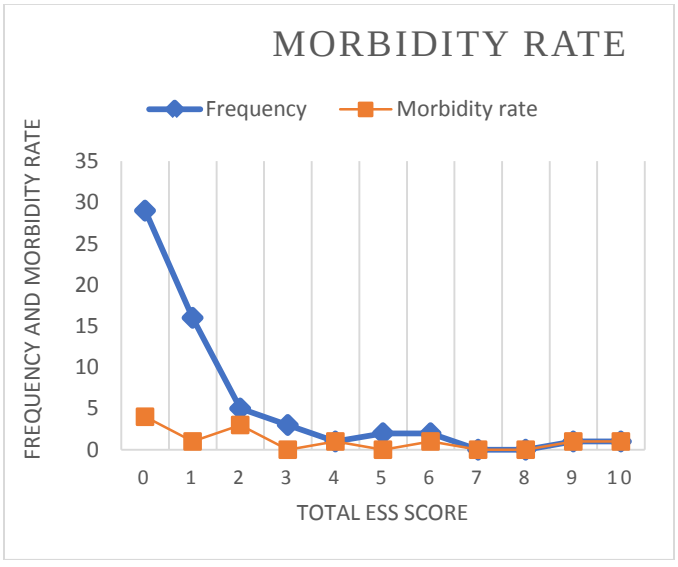
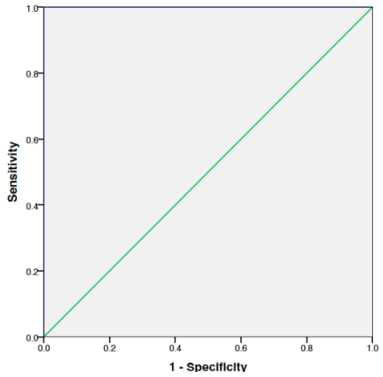
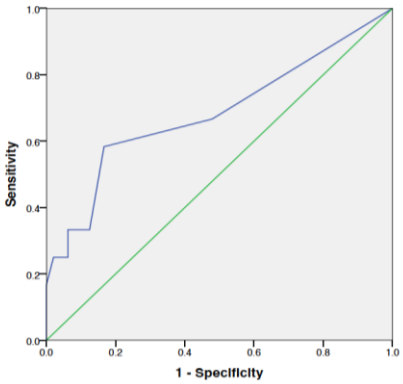


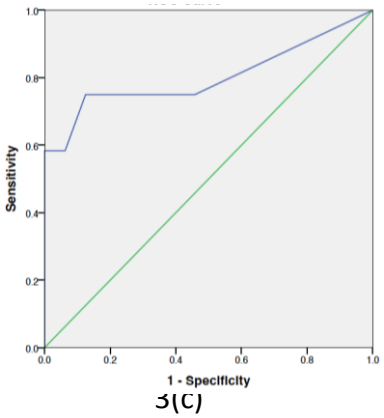
Figure 1. Morbidity rate at each ESS score



3(a)



3(b)



3(c)

Figure 3. Receiver operator (ROC) curves using ESS score concerning morbidity (a), mortality (b) and ICU admission (c)

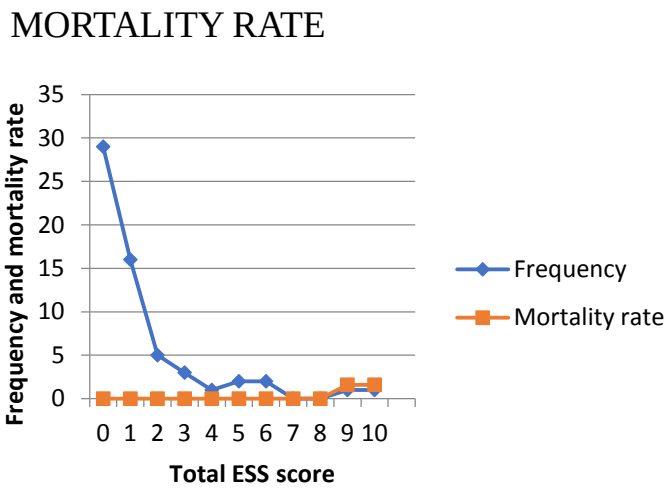


Figure 2. Motality rate at each ESS score

DISCUSSION

Our study found that ESS predicts predict postoperative morbidity and mortality in patients undergoing an emergency operation. The morbidity and mortality increase with the increase in ESS score.

Though there are other surgical risk calculators like NSQIP risk calculator, the Portsmouth-Physiology and Operative Severity Score for the enUmeration of Mortality (P-POSSUM), Surgical Risk Scale (SRS), and Surgical Outcome Risk Tool (SORT), which are meant of elective surgeries. [5,6,11,12] Emergency surgery itself has an inherent risk of higher complications and mortality.[3] Numerous studies have shown that ES is an independent predictor of poor postoperative outcomes.[1,2,13] So, the general risk predictors may not accurately predict the risk of emergency surgery. Similarly, there are risk or severity calculators for trauma which are organ-specific and do not take into consideration the physiological derangement due to the disease or injury.

Kaafarani et developed and validated the novel physiological emergency acuity score now known as the emergency surgery score (ESS).[10] It is based on 22 independent predictors of mortality in emergency surgery patients, including 3 demographic variables, 10 comorbidities, and 9 preoperative laboratory variables. The score ranges from 0 to 29 and can be calculated from information obtained from a patient's history and routine laboratory tests. They also prospectively validated this score in patients who underwent laparotomy for small bowel obstruction, mesenteric ischemia, complicated diverticulitis, and hollow viscus organ perforation. Emergency Surgery Score gradually and accurately predicted 30-day mortality; 3.5%, 50.0%, and 85.7% of patients with ESS of 3, 12, and 17 died after surgery, respectively, with a c-statistic of 0.84. Similarly, ESS gradually and accurately predicted complications; 21.0%, 57.1%, and 88.9% of patients with ESS of 1, 6, and 13 developed postoperative complications, with a c-statistic of 0.74. Emergency Surgery Score also accurately predicted which patients required intensive care unit admission (c-statistic, 0.80). Our study had AUC for morbidity and mortality of 1.0 and 0.684 respectively.

Another study from the same group ESS in emergency laparotomies. The ESS correlated with mortality (c-statistic = 0.84); scores of 1, 11, and 22 correlated with mortalities of 0.4%, 39%, and 100%, respectively. The ESS also correlated well with morbidity (c-statistic = 0.74); scores of 0, 7, and 11 correlated with complication rates of 13%, 58%, and 79%, respectively. The morbidity rates plateaued for scores higher than 11.[14]

Another study that evaluated ESS in elderly patients (>65 years) undergoing emergency general surgery. ESS accurately predicted mortality (AUC 0.81) in this population. Further analysis was done, which showed that even for

octogenarians and nonagenarians, ESS predicted mortality moderately well (AUC 0.77 and 0.69, respectively). [9]

ESS has also been used to predict postoperative ICU admission. A study found that an increase in ESS scores gradually predicted ICU need, with 1%, 40% and 98% of patients with ESS of 2, 9 and 16 requiring critical care, respectively. Only 6.2% of patients with ESS ≤7 had an ICU need, while 97.2% of patients with ESS ≥15 had an ICU need.[15] The c-statistic of the predictive model was 0.90. This is similar to our study. In our study, AUC for postoperative ICU admission was 0.802.

Predicting postoperative morbidity and mortality has certain advantages. ESS uses variables that are available preoperatively. So, it can be used at the bedside or preoperative counselling of the patient and their relatives regarding the possibility of postoperative complications and mortality in an objective manner. Having an objective score can also be used as a standard of the quality of service the surgeons and the hospital is providing. As ESS emphasizes the acuity of the disease and the physiological derangement, the morbidity and mortality could be measured or compared according to the acuity of disease and physiological derangement and compared with the similar risk patient at other surgeons or hospitals.

This score can also be used to stratify or triage the patient who are at more risk of postoperative morbidity and mortality so we could be more vigilant in their postoperative period and proactively manage any potential complication. This tool can also be used to rationalize the use of critical care beds which scare at most institutes the patients with higher scores and at higher risk of postoperative complications. If the critical care beds at not available at the index institute, it can be used to identify which patient needs to be transferred to the centre with a critical care facility.

Our study has certain limitations. This is a single-centre study with a limited number of cases, so the findings may not be generalized. We had to exclude a significant number of cases due to missing data and the unavailability of the records. A prospective study would be recommended to overcome this limitation.

CONCLUSION

Emergency surgery score predicts the morbidity and mortality in patients undergoing emergency surgery

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