POSSUM System In Predicting Morbidity and Mortality In Emergency Laparotomy Cases

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ABSTRACT

Objective   *To predict the morbidity and mortality in patients planned for emergency laparotomy procedure by utilizing physiological and operative severity score for the enumeration of morbidity and mortality (POSSUM) system.*

Study design   *Observational cross sectional study.*

Place & Duration of study   *Department of Surgery, Dow University of Health Sciences / Ruth Pfau Civil Hospital Karachi and Surgical Assessment Unit Shaheed Mohtarma Benazir Bhutto (SMBB) Institute of Trauma Karachi, from November 2021 to May 2023.*

Methods   *All patients between 15 years - 75 years of age who underwent emergency laparotomy were included. The POSSUM system was used to predict 30-days morbidity and mortality. Data were entered into the SPSS 23 and analyzed. Receivers operating curve (ROC) was computed to determine the discrimination ability of POSSUM system for predicting morbidity and mortality.*

Results   *A total of 200 patients were included in this study. Mean age of the patients was 28.72±13.89 years. Majority (n=163 - 81.5%) of the patients were males. The 30-days morbidity and mortality rates were 34.5% (n=69) and 7.0% (n=14) respectively. However, the area under curve (AUC) of POSSUM morbidity and mortality score was 0.540 and 0.796 respectively. It was statistically significant for mortality score only.*

Conclusion   *A weak discrimination ability of POSSUM morbidity score in predicting 30-days morbidity was found. However, POSSUM mortality score showed good discrimination ability in patients who underwent emergency laparotomy.*

Key words   *Peritonitis, Emergency laparotomy, Morbidity, Mortality, POSSUM system.*

INTRODUCTION:

Emergency laparotomy is a surgical procedure performed to treat acute abdominal conditions. This is often associated with high morbidity and mortality rate. Accurate preoperative risk assessment is crucial for optimizing patients' outcome and guiding clinical decision-making. The POSSUM system has a potential for predicting postoperative outcomes in patients who are in the need of emergency laparotomy.[1] The POSSUM system incorporates both physiological and operative variables to estimate the risk of morbidity and mortality.[2] The POSSUM system provides a good assessment of the preoperative and intraoperative risk factors that influence the postoperative morbidity and mortality.[3] Different studies have reported varying level of success in utilizing the POSSUM system.[4]

The estimated mortality rate following exploratory laparotomy is between 13% - 18% after a month.[5] The surgical outcome is not only dependent on the level of surgical care but also the status of the

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patients. To identify the high-risk population, preoperative evaluation of the physiological status of the patients, severity of illness, type of intervention, and comorbid are therefore crucial.[6] POSSUM system can predict the risk of complications in such patients that can help surgeons for deciding whether to proceed with surgery or otherwise.[7-9] This study was conducted to document our experience of usefulness of POSSUM system in patients who needed emergency laparotomy.

METHODS:

Study design, place & duration: This prospective observational cross sectional study was conducted in the Department of Surgery, Dow University of Health Sciences, Ruth Pfau Civil Hospital Karachi and Emergency Surgical Assessment Unit SMBB Trauma Center Karachi, from November 2021 to May 2023.

Ethical considerations: Synopsis of the study was approved by the REU of the College of Physicians & Surgeons Pakistan. Written informed consent was taken from the patients or their relatives, where applicable.

Inclusion criteria / Exclusion criteria: Patients between 15 years - 75 years of age, of any ASA class who required emergency laparotomy, were included in this study. Poly-trauma and immune-compromised patients such as those with malignancy, chronic kidney diseases, chronic liver diseases, asthma, COPD, HIV positive status and with genetic disorders, were excluded.

Sample size estimation: A sample of 200 patients was calculated by SPSS power analysis software, with receivers operating curve (H_1) 0.74[8], assuming ROC (H_0) 0.63, power 80% and confidence interval 95%. Non probability consecutive sampling technique was used.

Study protocol: Patients presenting to the emergency department and fulfilling the inclusion criteria were enrolled. A detailed demographic and clinical history was taken. Data were collected on a pre-designed form based upon the components of the POSSUM system. The physiological score of each patient was counted based on the parameters and preoperative severity score recorded by the operating surgeon. The postoperative morbidity and mortality were recorded. Patients were discharged from the hospital as per patients' condition. The follow-up was done until 30-days after the surgical procedure and complications were recorded.

Statistical analysis: Data were analyzed by using

IBM SPSS version 25.0. Mean and standard deviation or median with interquartile range (IQR) were reported on the basis of normality for quantitative variables such as age, duration of the surgical procedure and POSSUM count. For the qualitative variables such as gender, place of residence, comorbid conditions, smoking status, ASA class, indication of laparotomy, previous history of major surgery, morbidity and mortality were reported as frequency and percentages. Receivers operating curve (ROC) was computed to determine the discrimination ability of POSSUM system for predicting morbidity and mortality. Effect modifiers such as age, gender, and others were controlled through stratification.

RESULTS:
The mean age of the patients was 28.72±13.89 years and the mean duration of the surgery was 162.05±22.08 minutes. The mean physiological and operative severity scores were 25.02±7.04 and 19.48±3.76 respectively. Descriptive details of laboratory and hemodynamic parameters are mentioned in table I.

Majority of the patients were < 25 years (n=102 - 51%) of age. There were 163 (81.5%) males with male to female ratio of 4:1. Most (n=153 - 76.5%) of the patients belonged to the rural area. Ten (5.0%) patients were hypertensive, 30 (15.0%) diabetic and 21 (10.5%) smokers. Twelve (6.0%) patients had a history of major surgery and majority of the patients were of ASA class-I (n=154 - 77.0%) followed by ASA II (n=34 - 17.0%) and ASA III (n=12 – 6.0%). The most common indication of emergency laparotomy was peritonitis (n=145 - 72.5%). Details are given in table II.

The 30-days morbidity and mortality were reported in 69 (34.5%) and 14 (7.0%) patients respectively. ROC showed reasonable discriminating ability to predict the mortality in patients undergoing emergency laparotomy (AUC 0.796 - p <0.001) with confidence interval of 0.731 - 0.862. However, POSSUM morbidity score had a poor discrimination ability (AUC 0.540 - p=0.348) with confidence interval of 0.457 - 0.624. Graphic description is reported in Fig I and Fig II.

DISCUSSION:
This study on the usefulness of POSSUM system showed the mixed results. The POSSUM system was first described more than three decades ago and is still in use at different surgical settings because of its easy applicability.[10] However, the results varied in different studies. The original scoring system had
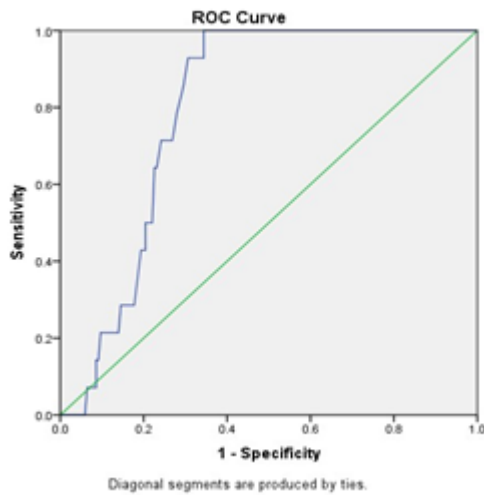
Fig I: Receivers Operating Curve of POSSUM system for predicting 30-days mortality in patients undergoing emergency laparotomy.
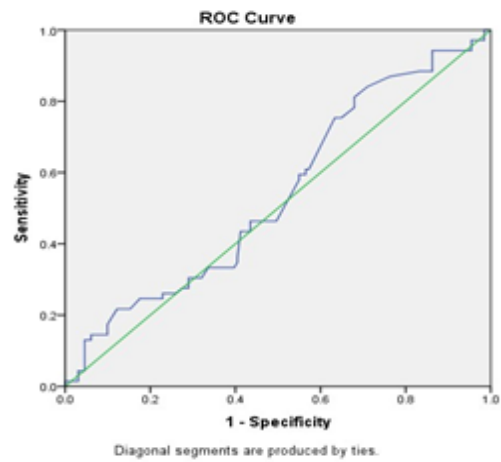

Fig II: Receivers Operating Curve of POSSUM system for predicting 30-days morbidity in patients undergoing emergency laparotomy.

Table I: Mean Distribution of Laboratory and Hemodynamic Parameters				
Variable	Mean	Standard Deviation	Minimum	Maximum
Hemoglobin (gm/dL)	12.42	2.29	8.9	18.0
WBC (mm^3)	14.79	6.10	2.9	26.0
Blood urea (mg/dL)	16.28	9.14	6.0	45.0
Serum sodium (mEq/L)	133.48	3.35	125	145
Serum potassium (mEq/L)	3.41	0.53	2.7	5.5
Systolic blood pressure (mmHg)	110.23	11.89	80	145
Heart rate (beats/min)	102.20	15.65	60	129

Table II: Indications of Emergency Laparotomy	
Indication	Frequency (%)
Perforated gallbladder	2 (1.0)
Burst abdomen	4 (2.0)
Intestinal obstruction	9 (4.5)
Penetrating abdominal injury	2 (1.0)
Perforated appendix	16 (8.0)
Peritonitis	145 (72.5)
Pyloric stricture	2 (1.0)
Rectal injury	2 (1.0)
Splenic Injury	14 (7.0)
Strangulated inguinal hernia	4 (2.0)

48 physiological factors and 14 operative and postoperative factors for each patient. Using multivariate analysis techniques these were reduced to 12 physiological and 6 operative factors. But still the validity of the system is not uniformly accepted. The aim of any surgical procedure done for different diseases is not only to treat the condition but also to reduce the morbidity and mortality associated with it. The patients' physiological status, the disease that requires surgical correction, severity of the disease, the nature of the operation and the preoperative and postoperative support services

have a major effect on the ultimate outcome.[11] It is evident to the surgeons that raw mortality and morbidity rates do little to explain these differences, and that the use of such statistics is at best inaccurate and misleading. To provide a comparative audit between different populations, measures of outcome must include methods to accommodate for differences in the cases.[12] These factors are responsible for the variable outcome reported while using POSSUM system.

The age of the patients in our study was from 15 years to 75 years which is an important factor to be noted. Most of the patients were in age group of < 25 years. All the patients underwent midline laparotomy incision as the procedure was performed in emergency without a definite diagnosis. Through this approach different procedures like appendectomy, resection anastomosis of intestine, omental patch closure and primary closure of the perforations were performed.[13,14] The most common indication for the surgery was peritonitis. The morbidity rate was 34.5%. This rate is lower as compared to the available literature. Most of the patients in our series were in younger age group and without comorbid. This may be a possible reason for this difference. In addition, difference in health delivery systems can also influence the results.[15]

Limitations of the study: Large population-based studies with long term follow-up are required to validate the results of our study.

CONCLUSION:
This study did not find optimal discrimination ability of POSSUM morbidity score. However, the mortality score showed good discrimination ability.

REFERENCES:

1. Anbarasu K, Chandak R. Efficacy of the P-POSSUM scoring system as a prognostic indicator in patients undergoing emergency laparotomy. Int Surg J. 2019;6:3600-7. DOI: http://dx.doi.org/10.18203/2349-2902.isj20194411.

2. Neary WD, Heather BP, Earnshaw JJ. The Physiological and Operative Severity Score for the enUmeration of Mortality and morbidity (POSSUM). Br J Surg. 2003;90:157-65. doi: 10.1002/bjs.4041.

3. Jonsson MH, Bentzer P, Turkiewicz A, Hommel A. Accuracy of the Physiological and Operative Severity Score for the enUmeration of Mortality and morbidity score and the Nottingham risk score in hip fracture patients in Sweden - A prospective observational study. Acta Anaesthesiol Scand. 2018;62:1057–63. doi: 10.1111/aas.13131.

4. Eichelmann AK, Saidi M, Lindner K, Lenschow C, Palmes D, Pascher A, et al. Impact of preoperative risk factors on outcome after gastrectomy. World J Surg Oncol. 2020;18(1):17. doi: 10.1186/s12957-020-1790-6.

5. Nandan AR, Bohnen JD, Sangji NF, Peponis T, Han K, Yeh DD, et al. The Emergency Surgery Score (ESS) accurately predicts the occurrence of postoperative complications in emergency surgery patients. J Trauma Acute Care Surg. 2017;83:84-9. doi: 10.1097/TA.0000000000001500.

6. Vivekanand KH, Mohankumar K. Dave P, Vikranth SN, Suresh TN. Clinical outcome of emergency laparotomy: our experience at tertiary care centre (A case series). Int J Biomed Adv Res. 2015;6:709-14.

7. Agarwal A, Choudhary GS, Bairwa M, Choudhary A. Apache II scoring in predicting surgical outcome in patients of perforation peritonitis. Int Surg J. 2017;4:2321-5.

8. Dhanraj M, Murugan P, Duraisami V, Rengan V. Evaluation of POSSUM scoring in patients undergoing emergency laparotomy for hollow viscus perforation. IAIM. 2018;5:21-6.

9. Barazanchi AWH, Xia W, MacFater W, Bhat S, MacFater H, Taneja A, et al. Risk factors for mortality after emergency laparotomy: scoping systematic review. ANZ J Surg. 2020;90:1895-902.

10. Stephens T, Johnston C, Hare S. Quality improvement and emergency laparotomy care: what have we learnt from recent major QI efforts? Clin Med. 2019;19:454-7.

11. Sreeharsha H, Sp R, Sreekar H, Reddy R. Efficacy of POSSUM score in predicting the outcome in patients undergoing emergency laparotomy. Pol Przegl Chir. 2014;86:159-65. doi: 10.2478/pjs-2014-0029.

12. Cao Y, Bass GA, Ahl R, Pourlotfi A, Geijer H, Montgomery S, et al. The statistical importance of P-POSSUM scores for predicting mortality after emergency laparotomy in geriatric patients. BMC Med Inform Decis Mak. 2020;20(1):86. doi: 10.1186/s12911-020-1100-9.

13. Columbus AB, Morris MA, Lilley EJ, Harlow AF, Haider AH, Salim A, et al. Critical differences between elective and emergency surgery: identifying domains for quality improvement in emergency general surgery. Surgery. 2018;163:832-8. doi: 10.1016/j.surg.2017.11.017.

14. Garg N, Bandi A. Evaluation of predictive value of P-POSSUM score in patients operated for acute abdomen and comparison of scoring at admission and pre-operatively. Indian J Surg. 2021;83:188-93.

15. Bhalsod H, Ramteke HB. An evaluation of the POSSUM score's efficacy in predicting the outcome of patients undergoing a laparotomy-a study protocol. J Pharmaceut Res Int. 2021;33:2142-5. doi: 10.9734/jpri/2021/v33i60B34856.

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Akram Rajput: Manuscript review, data analysis
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