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Evaluation of Possum and P Possum Scoring Systems in Patients Undergoing Emergency Abdominal Surgeries

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Abstract: ***Background: Emergency abdominal surgeries are critical procedures performed urgently to address life-threatening conditions within the abdomen. These surgeries are often necessitated by acute conditions such as appendicitis, intestinal obstruction, perforated ulcers, or traumatic injuries. The goals of emergency abdominal surgeries include relieving pain, removing damaged tissue or organs, controlling bleeding, and restoring normal function to the abdomen. Recovery can vary widely depending on the severity of the condition and the patient's overall health. POSSUM (Physiological and Operative Severity Score for the enumeration of Mortality and morbidity) and its modified version P-POSSUM are scoring systems used in surgery to predict outcomes based on preoperative risk factors and intraoperative variables. P-POSSUM refines this by adjusting for overestimation biases seen in POSSUM, particularly in lower-risk patients. This study aims to evaluate the efficacy and accuracy of both scoring systems for surgical risk assessment in predicting postoperative mortality and morbidity in patients undergoing emergency abdominal surgeries. Materials and Methods: The study was approved by institutional ethical committee. We retrospectively analysed POSSUM and P-POSSUM in 75 patients undergoing emergency abdominal surgery from April 2023 to April 2024 in RL JALAPPA hospital were evaluated. Physiological scoring was done prior to surgery and operative scoring was performed intra-operatively. The observed mortality rate was then compared with POSSUM and P-POSSUM predicted mortality rates. Results: POSSUM predicted a morbidity rate of 58, whereas the actual morbidity rate was 46 ($p < 0.05$). PPOSSUM predicted a morbidity rate of 54, whereas the actual morbidity rate was 46 ($p < 0.05$). POSSUM predicted a mortality rate of 11, whereas the actual mortality rate was 10 ($p < 0.05$). P-POSSUM predicted a mortality rate of 13, whereas the actual mortality rate was 11 ($p < 0.05$). Conclusions: With a reasonably good prediction of morbidity and mortality rate, POSSUM and P-POSSUM scores are both effective scoring systems in clinical practice for use in abdominal surgery***

Keywords: Emergency Exploratory laparotomy, POSSUM, P-POSSUM (The Portsmouth Physiological and Operative Severity Score for the enumeration of Mortality and morbidity)

1. Introduction

When there is severe, unexplained abdominal discomfort that either doesn't go away or becomes worse quickly, an emergency laparotomy is performed; Acute abdominal trauma that necessitates immediate surgical exploration, abdominal bleeding that appears to be internal, signs of peritonitis (inflammation of the abdominal lining), which can be brought on by a ruptured appendix, a perforated intestine, or other conditions, and intestinal obstruction that is causing severe symptoms and is not improving with non-surgical measures.

An important surgical procedure, an exploratory laparotomy carries a number of dangers, such as bleeding, anesthesia-related responses, infection, injury to surrounding organs, pneumonia, and blood clots. Following surgery, a protracted hospital stay is usual[1].

They have ten times the risk of the same with notable mortality and morbidity.1 Outcome: variables connected to the procedure and the patient.1 of which has a 5-to 21% (30-day mortality rate) chance of death for high-risk operations.

The POSSUM (Physiological and Operative Severity Score for the enumeration of Mortality and morbidity) scoring system was introduced in the 1990s as a tool to predict the risk of morbidity and mortality following surgery. It was developed based on a large dataset of surgical patients to incorporate both physiological parameters (like heart rate, blood pressure) and operative factors (like type and extent of surgery)[2].

Recognizing the overestimation of risk in certain patient groups, particularly lower-risk cases, the P-POSSUM (Portsmouth POSSUM) scoring system was later introduced. P-POSSUM adjusted the original POSSUM model to improve its accuracy across a broader range of surgical cases, refining its predictive power by calibrating for different patient demographics and surgical scenarios.

Both POSSUM and P-POSSUM have become valuable tools in surgical practice, assisting clinicians in preoperative risk assessment, decision-making, and patient counseling regarding potential postoperative outcomes[3].

Objectives

To evaluate POSSUM and P-POSSUM score in Predicting Mortality In Emergency Laparotomies findings in Tertiary Care Centre.

2. Methodology

Study Design, Sample Size and Source Of Data:

The study was approved by institutional ethical committee. Retrospective study taking patients who have undergone EMERGENCY EXPLORATORY LAPAROTOMY. 75 study subjects are taken from the Department of General surgery, Sri Devaraj Urs Medical College over period of 1 year april 2023 to april 2024.

Inclusion Criteria:

The inclusion criteria were (a) patients who underwent emergency abdominal surgeries at RLJH, Kolar during the study period, (b) patients who provided informed consent for the study.

Exclusion Criteria

(a) Patients under the age of 18 years
(b) Patients who were immune suppressed

Data Collection:

After obtaining the ethical clearance for the retrospective study, all patients who underwent emergency laparotomy in R.L. Jalappa Hospital, Tamaka were included . Data was collected retrospectively from prospectively maintained hospital database. Information was taken from medical record department. All variables needed for the study were recorded.

Statistical Analysis:

After collecting, the Data were compiled using Microsoft excel and analysis was done using SPSS software version 16. All continuous variables were represented as Mean and standard deviation and categorical variables were expressed percentages and proportions. The test of significance was unpaired (independent) test. The test was considered significant if p value was <0.05 for 95 % confidence intervals.

POSSUM and P-POSSUM POSSUM: included two types of scores, six operative severity scores (OS) and 12 physiology scores (PS). Each component was classified based on increasing scores (1, 2, 4, and 8). Physiological scoring was calculated prior to surgery and the operative scoring was calculated during or intra-operatively. By substituting PS and OS into regression equations, the POSSUM scoring system predicted the postoperative complication rate (R1) and mortality rate (R2), and the P-POSSUM predicted the postoperative mortality rate (R). The calculation equation was as follows:

$\ln R1 / (1 - R1) = -5.91 + 0.16 * PS + 0.19 * OS$
$\ln R2 / (1 - R2) = -7.04 + 0.13 * PS + 0.16 * OS$
$\ln R / (1 - R) = -0.065 + 0.1692 * PS + 0.1550 * OS$

Table 1: Possum Parameters

PHYSIOLOGICAL	OPERATIVE
1. Age	1. Operative severity
2. Cardiac signs	2. Multiple procedures
3. Respiratory signs	3. Total blood loss (mL)
4. ECG changes	4. Peritoneal contamination
5. Systolic BP (mmhg)	5. Presence of Malignancy
6. Pulse rate (beats/min)	6. Mode of surgery
7. Haemoglobin	
8. WBC ($x10^{12/L}$)	
9. Urea (mg/dl)	
10. Sodium (mmol/L)	
11. Potassium (mmol/L)	
12. GCS	

Table 1: Parameters to calculate POSSUM score POSSUM, physiological and operative severity score for the enumeration of mortality and morbidity.

Table 2: Distribution of patients according to age

Intervals	Frequency	Percentage
21-30	21	28
31-40	32	43
41-50	14	19
51-60	6	8
61-70	2	2
TOTAL	**75**	**100**

Table 3: Distribution of patients according to peritoneal contents

Peritoneal Content	Frequency	Percentage
BILE	38	51
FECES	8	11
BLOOD	12	16
SEROUS FLUID	4	5
PUS	2	2
NIL	11	15
TOTAL	**75**	**100**

Table 4: Distribution of patients according to physiological score

Physiologic Score	Frequency	Percentage
15-20	11	14.67
21-25	32	42
26-30	25	34
31-35	5	6.67
36-40	1	0.3
41-45	1	0.3
TOTAL	**75**	**100**

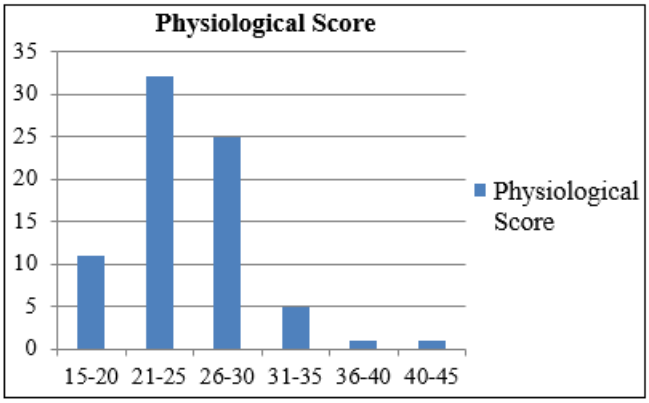
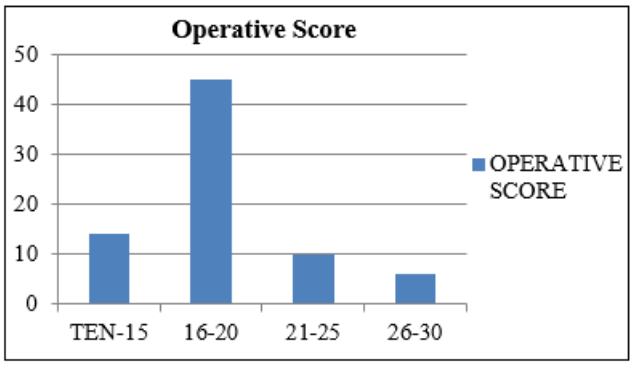


Figure 1: Histogram showing the distribution of patients according to the physiological score

Physiological score: The physiological scores ranged from 15 to 43, with a mean score of 24.57. A total of 42% (32) patients had a physiological score between 21 and 25, 34% (25) of patients had a physiological score of 26-30, 14.67% (11) patients had a physiological score of 15-20, whereas only 0.67% (1) patients had a physiological score of 41-45 (Table 4; Figure 1).

Table 5: Distribution of patients according to operative score

Operative Score	Frequency	Percentage
10-15	14	19.33
16-20	45	59.33
21-25	10	13.33
26-30	6	8
TOTAL	**75**	**100**



59.33% (45) subjects had an operative score of 16-20 and 19.33% (14) subjects had an operative score of 10-15, whereas only 8% (6) subjects had an operative score of 26-30 (Table 5).

Table 6: Comparison of morbidity predicted by POSSUM scoring to actual morbidity POSSUM, Physiologic and Operative Severity Score for the Study of Mortality and Morbidity.

Possum Predicted Mortality	No. of Patients	Predicted No. of Deaths	Observed No. of Deaths	Observed: Expected
0.00-0.10	0	0	0	0
0.11-0.20	0	0	0	0
0.21-0.30	0	0	0	0
0.31-0.40	0	0	0	0
0.41-0.50	0	0	0	0
0.51-0.60	4	2	2	0.8
0.61-0.70	14	10	5	0.53
0.71-0.80	27	19	16	0.87
0.81-0.90	29	26	22	0.83
0.90-1.00	1	1	1	100
0.00-1.00	**75**	**58**	**46**	**0.79**

The number of morbidities predicted by POSSUM was 58, whereas the actual observed number of morbidities was 46. The difference was statistically significant ($p < 0.05$) (Table 6).

Table 7: Comparing morbidity predicted by P-POSSUM scoring to actual morbidity

P-Possum Predicted Mortality	No. of Patients	Predicted No. of Deaths	Observed No. of Deaths	Observed: Expected
0.00-0.10	0	0	0	0
0.11-0.20	0	0	0	0
0.21-0.30	0	0	0	0
0.31-0.40	0	0	0	0
0.41-0.50	1	1	0	0
0.51-0.60	4	3	3	1
0.61-0.70	25	16	12	0.73
0.71-0.80	26	18	16	0.86
0.81-0.90	19	16	15	0.94
0.90-1.00	0	0	0	0
0.00-1.00	**75**	**54**	**46**	**0.84**

The number of morbidities predicted by P-POSSUM was 54, whereas the actual observed number of morbidities was 46. The difference was statistically significant ($p < 0.05$) (Table 7).

Table 8: Comparing mortality predicted by POSSUM scoring to actual mortality

Possum Predicted Mortality	No. of Patients	Predicted No. of Deaths	Observed No. of Deaths	Observed: Expected
0.00-0.10	4	1	0	0
0.11-0.20	17	2	1	0.2
0.21-0.30	12	1	0	0
0.31-0.40	16	2	1	0.4
0.41-0.50	16	2	4	1.8
0.51-0.60	4	1	2	5
0.61-0.70	4	1	1	2
0.71-0.80	1	1	1	1
0.81-0.90	1	1	1	1
0.90-1.00	0	0	0	0
0.00-1.00	**75**	**11**	**10**	**0.91**

The number of deaths predicted by POSSUM was 11, whereas the actual observed number of deaths was 11. The difference was statistically significant ($p < 0.05$) (Table 8).

Table 9: Comparing mortality predicted by P-POSSUM scoring to actual mortality

P- Possum Predicted Mortality	No. of Patients	Predicted No. of Deaths	Observed No. of Deaths	Observed: Expected
0.00-0.10	31	4	1	0.11
0.11-0.20	19	3	2	0.67
0.21-0.30	10	1	2	1.33
0.31-0.40	10	1	3	3
0.41-0.50	1	1	1	1
0.51-0.60	1	1	0	0
0.61-0.70	1	1	1	1
0.71-0.80	1	1	1	1
0.81-0.90	0	0	0	0
0.90-1.00	0	0	0	0
0.00-1.00	**75**	**13**	**11**	**0.84**

The number of deaths predicted by P-POSSUM was 13, whereas the actual observed number of deaths was 11. The difference was statistically significant ($p < 0.05$) (Table 9).

3. Discussion

An exploratory technique called an emergency laparotomy has widely varying clinical presentation, underlying disease, anatomical site of surgery, and perioperative management. Accurately assessing the risk of surgery using physiological and operative factors may aid in selecting the most appropriate course of action for individual patients depending on the projected risk.

Regression analysis using the POSSUM score system allows for the statistical prediction of morbidity and mortality. P-POSSUM was created as a better fit to the observed mortality rate due to its overestimation of the expected mortality. In the current study, only 2% of patients were between the ages of 61 and 70, while 43% of patients were between the ages of 31 and 40 and 28% were between the ages of 21 and 30. The age range of the patients was 21 to 66 years, with a mean age of 37. The average age of the patients involved in a study by Sergio González-Martínez et al. was 59.2 years[4].

Avinash Vishwani et al.'s study found that 25.8% of participants were between the ages of 21 and 30, and 19.1% were between the ages of 51 and 60[5]. According to a study by Dilip Kumar Das et al., study participants were 40.6 ± 16.67 years old on average. The study by Yang Cao et al. found that the mean age was 75.4 ± 7.3 years. There were 150 patients total; 41 were women and 109 were men. In a research by Singh et al., the male-to-female sex ratio was approximately 1.9:[16].

Due to confounding variables, the physiological score by itself is not a reliable indicator of the likelihood of problems developing. The operational scores in the current study varied from 12 to 30, with a mean score of 19.0[17].

Our investigation revealed that the observed-to-expected morbidity and mortality ratios were 0.79 and 0.91, respectively, for POSSUM and 0.84 and 0.84, respectively, for P-POSSUM, when comparing the two scoring systems. Both the POSSUM and P-POSSUM projected rates of morbidity and death were statistically significant ($p < 0.05$) and higher than the observed rates[8]. The findings demonstrate that in patients undergoing emergency abdominal procedures, POSSUM and PPOSSUM can reliably predict postoperative problems, with mortality prediction being more accurate in this regard than morbidity. The results align with those of previous investigations[9].

4. Conclusions

We can conclude that POSSUM and P-POSSUM scores have a moderate ability to predict mortality and morbidity rates in emergency abdominal surgery patients.

Limitations:

- Retrospective study
- Less sample size
- Multiple surgeons
- Different approach to surgery

Declarations

- Funding: None
- Conflict of interest: None
- Ethical approval: Taken

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