

Original Research Article

A PROSPECTIVE STUDY OF POSSUM SCORE IN PREDICTING MORTALITY AND MORBIDITY IN PERFORATION PERITONITIS

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ABSTRACT

Background: POSSUM (Physiologic and Operative Severity Score for the Study of Mortality and Morbidity) is used for Surgical Assessment in Patients Undergoing Emergency Abdominal Surgeries. This study aimed to evaluate the efficacy of POSSUM score in predicting the mortality and morbidity in patients with perforation peritonitis.

Materials and Methods: A prospective observational study was conducted among patients aged 18 years and above with established peritonitis following hollow viscus perforation and those willing to participate for a period of one year. A detailed clinical history was obtained. Using a predesigned data tool and, results from investigations done preoperatively and operative findings and post operative histology were collected.

Results: 31 patients satisfied the inclusion criteria and were included in the study. Mean age of patients was 54.8±18.7 years. Most common site of perforation noted was prepyloric region (n=18) followed by ileal perforation (n=8). Thirteen patients had no complications accounting for 41.9 percentage. Among the dead patients four patients had POSSUM score ranging between 40 and 49 and three patients had POSSUM score ranging between 50 and 59.

Conclusion: It can be concluded that the POSSUM score demonstrates a moderate capacity to forecast mortality and morbidity rates among patients undergoing emergency abdominal surgery. The POSSUM scoring system serves as a valuable tool for evaluating surgical outcomes, thereby aiding in the effective management of patients. Implementing the POSSUM score in our setting can enhance patient counselling, improve surgical results, and optimize the use of limited resources and personnel.

Keywords: POSSUM score, peritonitis, Emergency Abdominal Surgeries.

INTRODUCTION

Every year, many patients worldwide need emergency abdominal surgery for a variety of conditions, including peritonitis, invasive malignant

tumors, gastrointestinal tract perforations, small bowel obstruction, intraabdominal haemorrhages, and blunt or penetrative abdominal injuries. About 11% of all surgical procedures in affluent nations include emergency surgery, which can account for nearly half of surgical deaths and one-third of

surgical complications. Compared to elective surgery, postoperative results after emergency abdominal surgery are typically worse.^[1]

Various scoring system have been used for predicting the outcome of patients with perforation peritonitis. The most widely used scoring system is Acute physiological and chronic health evaluation 2 (APACHE 2) which is ideal for intensive care patient but requires 24 hours of observation.^[2] Copeland developed a scoring system which includes 12 physiological factors and 6 operative factors for calculating the risk of morbidity and mortality in patients with perforation peritonitis.^[3]

POSSUM (Physiologic and Operative Severity Score for the Study of Mortality and Morbidity) is used for Surgical Assessment in Patients Undergoing Emergency Abdominal Surgeries. Every surgical procedure's outcome is influenced by several variables, including the surgeon's experience, the patient's current health, the type of surgical intervention, and any co-morbid diseases. At present, there is no universally recognized scoring system to assess the prognosis of peritonitis and intra-abdominal sepsis. The POSSUM (physiological and operative severity score for the enumeration of mortality and morbidity) was created by Copeland and colleagues. This scoring system has been suggested to standardize patient data, enabling direct comparisons of patient outcomes despite variations in referral patterns and populations. By utilizing POSSUM, healthcare providers can better identify patients who are at a higher risk of experiencing complications and mortality.^[4] With this background this study aimed to evaluate the efficacy of POSSUM score in predicting the mortality and morbidity in patients with perforation peritonitis.

MATERIALS AND METHODS

Patients presented with perforation peritonitis to emergency department in SVIMS between November 2023 to October 2024 were prospectively screened for inclusion in the study.

All the patients aged above 18 years of age, patients with established peritonitis following hollow viscus perforation and those willing to participate in the study after informed consent were included in the study. Those patients with Age less than 18 years and patient with primary peritonitis due to tuberculosis, alcoholic cirrhosis, systemic lupus erythematosus, nephrotic syndrome and cardiac failure were excluded.

The study was initiated after obtaining clearance by the Institutional Ethics Committee (IEC No.; Letter

Roc.No.AS/11/IEC/SVIMS/2017). A written informed consent form (Annexure 1) was obtained from all individuals participated in the study prior to screening.

Study procedure: All patients with signs and symptoms of perforation peritonitis were included in the study. A detailed clinical history was obtained regarding the symptoms such as abdominal pain, abdominal distension, nausea, vomiting, fever, and altered bowel habits along with other co-morbidities such as diabetes, hypertension, coronary artery disease and chronic kidney disease.

General examination of the patient included blood pressure, pulse, respiratory rate and Glasgow Coma Scale. Blood investigations and investigations guided by symptoms were sent and pre-anaesthetic workup as advised by the anaesthetist was done. Using a predesigned data tool and, results from investigations done preoperatively and operative findings and post operative histology were collected. Patients were followed up for a month in Outpatient Department and a follow up phone call was done for those not available for review. The actual calculation for the risk scores was done with a computer program utilising the standard formulae. The calculated risk scores for individual patients were stratified according to magnitude then compared with the actual observed number of mortalities or morbidities. Data was recorded on a predesigned proforma and managed using a Microsoft Excel worksheet (Microsoft Corp, Redmond, WA). All the entries were double-checked for any possible error. Descriptive statistics for categorical variables were performed by computing the frequencies (percentages) in each category. Using outcome (dead/alive or uncomplicated/complicated) as a dichotomous variable comparison between predicted and observed mortality and morbidity rates were assessed using chi-square test and statistical significance determined. For the quantitative variables, the approximate normality of distribution was assessed and the differences between the groups were assessed using student's t-test. The statistical software IBM SPSS Statistics Version 30 (IBM Corp Somers NY, USA) was used for statistical calculations. The receiver operating characteristic (ROC) curve was plotted with sensitivity against 1-specificity.

RESULTS

A total of 40 patients with peritonitis were assessed for eligibility 31 patients satisfied the inclusion criteria and were included in the study.

Table 1: Distribution according to socio-demographic factors, vitals and serum electrolytes

Variable		Frequency	Percentage
Age	<60 years	18	58.1
	60-70 years	6	19.4
	>70 years	7	22.6
Gender	Female	4	12.9
	Male	27	87.1

Addictions	Alcoholic	14	45.2
	Alcoholic and smoker	2	6.5
	Smoker	6	19.4
	No addictions	9	29.0
Pulse rate (BPM)	<100	5	16.1
	100-110	6	19.3
	111-120	5	16.1
	121-130	11	35.4
	131-140	4	12.9
Systolic BP (mm of Hg)	91-100	8	25.8
	101-110	6	19.3
	111-120	14	45.1
	121-130	1	3.2
	131-140	2	6.4
Serum sodium (mmol/L)	<135	8	25.8
	135-145	18	58.0
	>145	5	16.1
Serum potassium (mmol/L)	<3.5	7	22.5
	3.5-4.5	19	61.2
	>4.5	5	16.1
White blood cells (/cmm)	<6000	6	19.3
	6000-11000	9	29.0
	>11000	16	51.6

The maximum age of patient with diagnosis of perforation peritonitis in the present study was noted as 87 years while minimum age was 22 years. Mean age of patients was 54.8 ± 18.7 years. The present study showed male preponderance with 87.1 percent of males and 12.9 percent of females. Most of the patients with perforation peritonitis in the present study found have history of alcohol consumption (n=14) accounting for 45.2%. Most of the patients (n=11) had pulse rate ranging between 121 and 130 beats per minute. The mean pulse rate is

111.71 ± 15.6 . Most of the patients (n=14) had blood pressure ranging between 111 mm Hg to 120 mm of Hg. The mean blood pressure is 104.84 ± 12.075 . Most of the patients (n=18) had serum sodium ranging between 135-145. The mean sodium value is 138.29 ± 7.053 . Most of the patients (n=19) had serum potassium ranging between 3.5 and 4.5. The mean potassium is 3.942 ± 0.7843 . Most of the patients (n=16) had total counts more than 11,000 cells per cubic millimetre. The mean total count is 11448.39 ± 6483.305 .

Table 2: Distribution according to site of perforation, operative procedure and post op complications, mortality, POSSUM score

Variable		Frequency	Percentage
Site of perforation	Pre pyloric perforation	18	58.1
	Ileal perforation	8	25.8
	Sigmoid colon perforation	2	6.5
	Jejunal perforation	2	6.5
	Appendicular perforation	1	3.2
Procedure	Graham's Omental patch repair	19	61.3
	Resection and anastomosis	5	16.1
	Colostomy	2	6.5
	Ileostomy	4	12.9
	Appendectomy	1	3.2
Postoperative complications	Uncomplicated	13	41.9
	Respiratory infection	7	22.6
	Wound dehiscence	4	12.9
	Septic shock	7	22.6
Mortality	Alive	23	74.2
	Dead	8	25.8
POSSUM score	30-39	9	29.0
	40-49	11	35.4
	50-59	10	32.2
	70-79	1	3.2

Most common site of perforation noted was prepyloric region (n=18) followed by ileal perforation (n=8). Most of the patients underwent Graham's omental patch repair for prepyloric perforation. Resection and anastomosis was done in 5 patients and ileostomy was done in 4 patients for small bowel perforation. Colostomy was done in 2 patients for sigmoid colon perforation and appendectomy was done in 1 patient for appendicular perforation.

Thirteen patients had no complications accounting for 41.9 percentage. Seven patients had suffered from respiratory infections (22.6%) and another seven had septic shock (22.6%). Four patients had suffered from wound dehiscence accounting for 12.9%. Out of 31 patients of perforation peritonitis underwent emergency surgery, 74.2 percentage (n=23) of patients were alive and 25.8 percentage (n=8) of patients were dead. The present study showed that most of the patients (n=11) with perforation

peritonitis had POSSUM score ranging between 40-49 accounting for 35.4%.

Table 3: Association between mortality and site of perforation and POSSUM score

Variable		Mortality		P value
		Alive No. (%)	Dead No. (%)	
Site of perforation	Appendicular perforation	1 (3.2)	0 (0)	0.583
	Ileal perforation	5 (16.1)	3 (9.7)	
	Jejunal perforation	1 (3.2)	1 (3.2)	
	Pre pyloric perforation	15 (48.4)	3 (9.7)	
	Sigmoid colon perforation	1 (3.2)	1 (3.2)	
POSSUM Score	30-39	9	0	0.042
	40-49	7	4	
	50-59	7	3	
	70-79	0	1	

In the present study, it was observed that there is no statistically significant association between site of perforation and mortality of patient ($p=0.583$). Among the dead patients four patients had POSSUM

score ranging between 40 and 49 and three patients had POSSUM score ranging between 50 and 59. With increased POSSUM score, there is statistically significant increase in mortality ($p=0.042$).

Table 4: Morality and microbiological cultures in present study

Organisms isolated	Mortality Rate				Total		P Value
	Alive		Dead				
	No.	%	No.	%	No.	%	
Candida albicans	2	6.5	0	0.0	2	6.5	0.231
Candida non albicans	1	3.2	0	0.0	1	3.2	
Enterococcus and Klebsiella	0	0.0	1	3.2	1	3.2	
Enterococcus faecalis	1	3.2	0	0.0	1	3.2	
Escherichia coli	10	32.3	3	9.7	13	41.9	
Escherichia coli and Enterococcus faecium	1	3.2	0	0.0	1	3.2	
Escherichia coli and Staphylococcus hominis	1	3.2	0	0.0	1	3.2	
Escherichia coli, Proteus mirabilis and Escherichia coli	1	3.2	0	0.0	1	3.2	
Klebsiella and Escherichia coli	0	0.0	2	6.5	2	6.5	
Klebsiella and Proteus	0	0.0	1	3.2	1	3.2	
Klebsiella and Pseudomonas	1	3.2	1	3.2	2	6.5	
Non hemolytic streptococci	1	3.2	0	0.0	1	3.2	
Staphylococcus hominis	3	9.7	0	0.0	3	9.7	
Staphylococcus hominis and Candida albicans	1	3.2	0	0.0	1	3.2	

In the present study, it was observed that there is no statistically significant association between

microbiological culture and mortality of patient ($p=0.231$)

Table 5: Predicted mortality vs actual mortality in the present study

Predicted mortality using POSSUM Score (derived from Logistic Regression)	Actual mortality		Total
	Dead	Alive	
Dead	7	0	7
Alive	1	23	24
Total	8	23	31
Sensitivity	50%		
Specificity	74%		

Table 6: Predicted morbidity vs actual morbidity in the present study

Predicted morbidity (derived from Logistic Regression)	Actual morbidity		Total
	Complicated	Uncomplicated	
Complicated	7	1	8
Uncomplicated	11	12	23
Total	18	13	31
Sensitivity	78%		
Specificity	69%		

Table 7: The association between variables and mortality rate

Mortality Rate		N	Mean	Std. Deviation	P Value
Age in Years	Dead	8	60.25	10.166	0.345
	Alive	23	52.87	20.744	
Systolic Blood Pressure	Dead	8	93.75	7.440	0.001
	Alive	23	108.70	10.998	
Pulse	Dead	8	125.38	10.783	0.003
	Alive	23	106.96	14.342	

Urea	Dead	8	86.88	29.911	0.001
	Alive	23	42.74	27.247	
Sodium	Dead	8	144.75	9.146	0.202
	Alive	23	136.04	4.557	
Potassium	Dead	8	4.25	1.073	0.669
	Alive	23	3.83	0.653	
Hemoglobin	Dead	8	12.61	3.599	0.342
	Alive	23	12.13	2.409	
White cell count	Dead	8	9537.50	10150.853	0.090
	Alive	23	12113.04	4768.963	
Blood loss per operation	Dead	8	56.25	17.678	0.037
	Alive	23	50.00	0.000	
Total Score	Dead	8	47.88	8.790	0.007
	Alive	23	41.30	6.799	

Independent t test is used as test for significance.

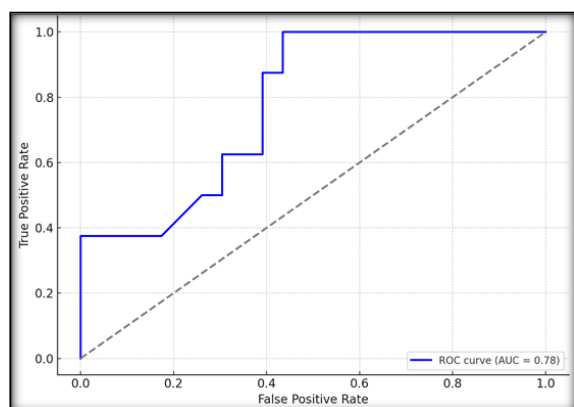


Figure 1: Receiver operating characteristic curve for mortality.

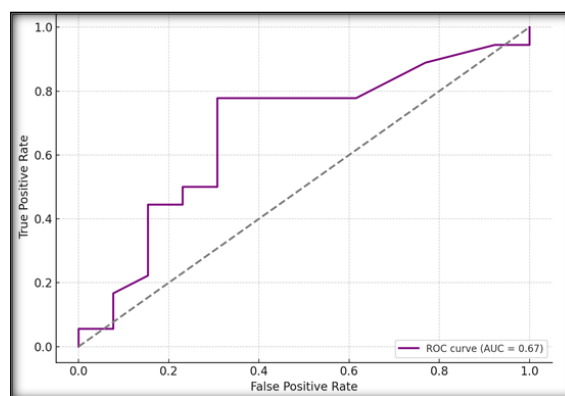


Figure 2: Receiver operating characteristic curve for morbidity.

Table 8: Diagnostic accuracy for Mortality using POSSUM score

Diagnostic accuracy	
Sensitivity	50%
Specificity	74%
Positive predictive value	40%
Negative predictive value	81%

Table 9: Diagnostic accuracy for Mortality using POSSUM score

Diagnostic accuracy	
Sensitivity	78%
Specificity	69%
Positive predictive value	78%
Negative predictive value	69%

DISCUSSION

In this current study 31 patients underwent emergency laparotomy for perforation peritonitis. Out of the 31 patients males were 27 and females were 4. The most common age group affected is < 60 years. 8 patients died and a crude mortality rate of 25.8% is observed. The most common cause of death is septic shock. Out of 31 patients 18 patients had complications. The crude morbidity rate is 58.1%. The most common complication seen in the present study were respiratory infection followed by septic shock and wound dehiscence. The observed mortality rate is 25.8% and morbidity rate 58.1% which is similar to the results seen in the study done by Shekar et al⁵ and Chatterjee et al^(32,33).^[6] The O/E ratio for mortality is 0.67 and O/E ratio for morbidity is 0.70 which is similar to the studies done by Shekar et al O/E ratio for mortality is 0.91 and O/E ratio for

morbidity 0.79. Another study done by Chatterjee et al⁶ showed that O/E ratio for mortality is 1.005 and O/E ratio for morbidity is 1.001. The results in our study are comparable to other studies. The AUC for mortality is 0.78 and for morbidity is 0.67.

In the present study, the mean age of 54.8 ± 18.7 years was noted which is comparable to study done by Shekar et al (37 years)⁵ and Chatterjee et al (40 years).^[6] In the present study, males were mostly commonly affected when compared to females which is comparable to study by Shekar et al,^[5] and Chatterjee et al.^[6]

In the present study, most common site of perforation is prepyloric perforation which is comparable to study done by Batra et al,^[7] (Gastroduodenal perforation), Chatterjee et al,^[6] (Duodenal perforation). In the present study, the most common procedure done is Omental patch repair which is similar to other studies by Nachiappan et al,^[8] and

Chatterjee et al.^[6] In the present study the observed mortality rate is 25.8% which is similar to other studies by Gurjar et al.^[9] and Chatterjee et al.^[6] In the present study the observed mortality rate is 25.8% which is similar to other studies by Shekar et al.^[5] (19%) and Chatterjee et al (18%).^[6] In the present study the observed morbidity rate is 58.1% which is similar to other studies by Shekar et al (61%) and Chatterjee et al (61%).^[5,6]

In the present study, the O/E mortality ratio is 0.67. The O/E ratio of other studies by Shekar et al (0.91) and Chatterjee et al (1.005).^[5,6] In the present study, the O/E morbidity ratio is 0.70 which is comparable to other studies by Shekar et al.^[5] (0.79) and Chatterjee et al (1.001). In the present study, the sensitivity and specificity for mortality is 50% and 74%, which is comparable to other studies by Kumar et al.^[10] (sen=95%, spec=100%) and Chatterjee et al (sen=95% and spec=100%). In the present study, the sensitivity and specificity for morbidity is 78% and 69%, which is comparable to other studies by Kumar et al.^[10] (sen=71%, spec=96%) and Chatterjee et al (sen=71% and spec=96%).^[6]

In the present study, area under curve for mortality is and for morbidity, which is comparable to other studies Shekar et al.^[5] (AUC for mortality=0.818 and AUC for morbidity=0.943) and Chatterjee et al.^[6] (AUC for mortality=0.943 and AUC for morbidity=0.93).

The limitations of this study were Small sample size is the limitation of the study. Addictions, co-morbidities and perforation to operating time also account for the outcome of the patient with perforation peritonitis. Hence, additionally these factors should be included in the scoring system to improve the validity of POSSUM scoring system. This rating method can be further validated by studies with a bigger sample size. To decrease the length of time needed for perforation to operate and control co-morbidities, it is also necessary to implement broad awareness, early referrals, early diagnosis, and prompt treatment.

This can be concluded from this study that the patient's advancing age, prolonged symptom duration, progression of the disease, presence of generalized peritonitis with purulent or feculent discharge, initial shock upon presentation, and the onset of multi-organ failure are all linked to increased mortality rates and play a significant role in the poor prognosis for the patient. It can be concluded that the POSSUM score demonstrates a moderate capacity to forecast mortality and morbidity rates among patients undergoing emergency abdominal surgery. The POSSUM scoring system serves as a valuable tool for evaluating surgical outcomes, thereby aiding in the

effective management of patients. Implementing the POSSUM score in our setting can enhance patient counselling, improve surgical results, and optimize the use of limited resources and personnel. When appropriate logistical analyses are applied, the POSSUM score reliably predicts mortality and morbidity in patients with peritonitis undergoing laparotomy. Thus, the POSSUM score is applicable for predicting surgical outcomes in cases of emergency abdominal surgery.

CONCLUSION

It can be concluded that the POSSUM score demonstrates a moderate capacity to forecast mortality and morbidity rates among patients undergoing emergency abdominal surgery. The POSSUM scoring system serves as a valuable tool for evaluating surgical outcomes, thereby aiding in the effective management of patients. Implementing the POSSUM score in our setting can enhance patient counselling, improve surgical results, and optimize the use of limited resources and personnel.

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