



P-POSSUM: A SCORING SYSTEM FOR PERFORATION PERITONITIS

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ABSTRACT

Background and Objectives: Perforation peritonitis carries considerable morbidity and mortality with the postoperative period unpredictable most of the times. It therefore becomes necessary for a scoring system that predicts the post-operative outcome. POSSUM (Physiological and Operative Severity Score for the enumeration of Mortality and Morbidity) helps in predicting the postoperative morbidity and mortality in these patients. POSSUM scores are based on 12 physiological factors and 6 operative factors. In our study, we studied modification of POSSUM that is Portsmouth POSSUM in predicting morbidity and mortality in perforation peritonitis patients. Through this prospective study, we can predict which patients are at a higher risk of death or complication and give appropriate management as necessary. **Materials and Methods:** Our sample size was 40 patients with perforation peritonitis. The study was conducted in Department of Surgery PGIMS Rohtak from April 2021 to May 2022. Data was collected based on P-POSSUM scoring system. Outcome of the patients was recorded as death / alive; complicated / uncomplicated and statistical analysis was done by comparing the expected and observed outcomes. **Results:** An observed to expected ratio of 0.97 was obtained for morbidity and 1.08 for mortality. It was found to be comparable with other studies. It was also found that P-POSSUM was a better mortality indicator compared to POSSUM in terms of mortality with a p-value of 0.03. **Conclusion:** Although a small sample size is the limitation of this study, P-POSSUM scoring system is a good indicator of postoperative outcome in patients with perforation peritonitis and was applicable in our setup. It is useful in identifying high risk patients and give preferential care to them for better outcome. Also, P-POSSUM was a better mortality predictor compared to POSSUM.

KEYWORDS : P-POSSUM, Perforation Peritonitis**INTRODUCTION**

The notion that every surgeon is accountable for the outcome of the patient has been continuing from ancient times. But the outcome of the patient is dependent on the surgeon but also, the patient and his clinical condition. Doctors, especially surgeons are increasingly accountable for their actions to their own professional organizations through re-validation and also to media, the government and the population which we serve. There are limited indicators of quality of hospital care for surgical patients like crude morbidity and mortality which can be misleading when results are compared between different hospitals. Meaningful analysis of morbidity and mortality before treatment can be achieved by scoring systems. Perforation peritonitis is one of the most encountered surgical emergencies in which patient presents with acute abdomen. It is the most common surgical emergency in India¹. Peritonitis requires prompt medical attention to fight the infection and, if necessary to treat any underlying medical conditions. Mortality due to hollow viscous perforation ranges from 10% to 40%².

Crude morbidity and mortality rates are limited indicators of quality of care, and can be misleading when the results of emergency surgery are compared between different units and hospitals. Scoring systems that group patients based on the severity of illness before treatment can allow a meaningful analysis of morbidity and mortality rates.

The Physiological and Operative severity score for the enumeration of mortality and morbidity (POSSUM) developed by Copeland et al³ in 1991, provides a valuable tool for risk adjustment and stratification and this is widely used in various surgical settings. In a surgical review article, it was concluded that POSSUM scoring is the best scoring system available in surgical practice. It scores the physiological

status of patients and operative findings and all 12 physiological and 6 operative variables can be recorded easily and reproduced satisfactorily by resident staff without any difficulty.

The main disadvantage of POSSUM scoring is that it over predicts the mortality in some low risk patients. The Portsmouth predictor {P-POSSUM} modification proposed by Whiteley et al. counters this over prediction of mortality by POSSUM. It uses the same variables as POSSUM but uses a different formula for analysis⁴.

The present study has been designed to evaluate use of P-POSSUM scoring for predicting morbidity and mortality.

MATERIAL AND METHODS

FORTY patients of perforation peritonitis scheduled to undergo emergency laparotomy in General Surgery department PGIMS Rohtak from April 2021 to May 2022 were selected based on inclusion and exclusion criteria and scored according to P-POSSUM score.

Inclusion Criteria:

Patients having perforation peritonitis on exploratory laparotomy(operated)

Exclusion criteria:

Patients with age less than 12 years Immunosuppressed patients (retrovirus positive, post-transplant, steroid use) Patients with altered mental status (head injury, toxic encephalopathy) Patients of perforation peritonitis managed conservatively(not-operated) Patient who refused to give the consent for participation in the study.

Scores were allotted to the physiological and operative factors

in the study and expected mortality and morbidity rate were calculated. Complications were assessed by clinical observation.

Operative Severity Assessment for P-POSSUM SYSTEM⁴

Score	1	2	4	8
Operative Magnitude	Minor	Intermediate	Major	Major+
Blood loss per operation	<100	101-500	501-999	>1000
No. of procedures during operation	1	2	>2	
Peritoneal soiling	None	Serous	Local pus	Free bowel content, pus or blood
Malignancy	No	Primary cancer only	Node metastasis	Distant metastasis
Timing of operation	Elective	-	Emergency operation within 24 hours (>2 hour of resuscitation possible)	Emergency operation within 2 hours (<2 hour of resuscitation possible)

Physiological Severity Assessment for P-POSSUM SYSTEM⁴

Score	1	2	4	8
Age (in years)	<60	61-70	>71	-
Cardiac signs	Normal	Cardiac drugs/taking steroids	Oedema/taking warfarin, borderline cardiomegaly	JVP raised, Cardiomegaly
Respiratory signs(CXR)	Normal	Breathlessness on exertion, mild COPD	Breathlessness on walking, moderate COPD	Breathlessness on rest, any other changes in lungs
Systolic BP(mm Hg)	110-130	131-170,100-109	>171,90-99	<89
Pulse(beat/min)	50-80	80-100, 40-49	101-120	>121, <39
GCS	15	12-14	9-11	<8
Urea nitrogen (mmol/L)	<7.5	7.6-10	10.1-15	>15.1
Na (meq/L)	>136	131-135	126-130	<125
K (meq/L)	3.5-5	3.2-3.4 or 5.1-5.3	2.9-3.1 or 5.4-5.9	<2.8 or >6
Hb(g/dl)	13-16	11.5-12 or 16.1-17	10-11.4 or 17.1-18	<9.9 or >18.1
WBC(x10)	4-10	10.1-20.0 or 3.1-4	>20.1 or <3	
ECG	Normal		AF (60-90) MI>6 months ago	MI<6 months ago AF>90/min

P-POSSUM equation for morbidity-

$$\ln R/1 - R = - 5.91 + (0.16 \times \text{physiological score}) + (0.19 \times \text{operative severity score})$$

P-POSSUM equation for mortality-

$$\ln R/1 - R = - 9.37 + (0.19 \times \text{physiological score}) + (0.15 \times \text{Operative severity score})$$

Where R = predicted risk

After calculating R (Risk of mortality) for each patient, all patients were divided into different risk-bands on the basis that each band receives enough number of patients and deaths for statistical analysis. The Risk bands according to the predicted mortality are: -
 0-5% - Risk Band or group
 5-15% - Risk Band or group
 15-30% - Risk Band or group
 30-45% - Risk band or group
 45-100% - Risk band or group

The patients were then followed up for a period of 1 month's post operatively and complications were noted upon the criteria as defined by POSSUM scoring system.

RESULTS

The causes of perforation peritonitis in our study are given in [Fig-1]. Out of 40 patients studied, death occurred in 2 patients resulting in crude mortality rate of 5%. Of the 38 patients alive, 23 patients had at least one complication, resulting in crude morbidity rate of 57.5%. The remaining 15 patients showed no evidence of any complication. The complications during the 1 months follow up period were as follows in [Fig-2]. Comparison of observed and P-POSSUM predicted mortality and morbidity rates was done as is represented in [Table-1,2] respectively. Observed to expected mortality and morbidity ratios were 1.08 and 0.97 respectively. In our study we have also analysed the mortality scores predicted by POSSUM and compared it with scores obtained by P-POSSUM.

[Table-3] showing significance of p possum and possum in predicting mortality as observed possum overpredicts mortality and p possum being a better scoring system for predicting mortality. [Table-04/Fig-3] showing the ROC curve and significance of P-POSSUM in predicting mortality compared to POSSUM.

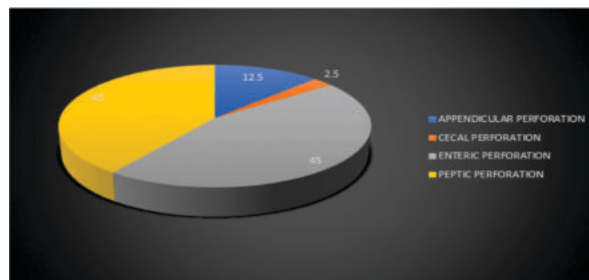


Fig1: Pie chart showing distribution of patient as per the cause of perforation

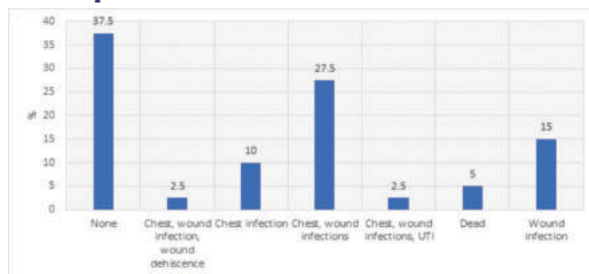


Fig2: Bar diagram showing the distribution of complications observed in the patients included in the current study

Table: Showing comparison of observed and predicted morbidity using P-POSSUM.

	FREQUENCY	O. MORB	PP. MORB	O/P RATIO
10-20	2	0.4	0.51	0.78
20-30	3	0.37	0.62	0.59
30-40	3	0.6	0.53	1.13
40-50	10	0.76	0.68	1.17

50-60	1	0.33	0.62	0.53
>60	6	1	0.59	1.69
	25	0.57	0.59	0.97

Table2: Showing comparison of observed and predicted mortality using P-POSSUM.

	O. MORT	PP MORT	O/P RATIO
10-20	0	2.38	0
20-30	1	1	1
30-40	0	1.32	0
40-50	1	2.12	0.47
50-60	0	1.2	0
>60	0	2.71	0
Total	2	1.85	1.08

Table3: showing significance of p possum and possum in predicting mortality as observed possum overpredicts mortality and p possum being a better scoring system for predicting mortality

	Diagnose	N	Mean	Std. Deviation	P value
PP MORT	live	38	7.66%	10.303%	0.001 (S)
	death	2	43.3%	14.42%	
P. MORT	live	38	1.91%	2.72%	0.48
	death	2	0.55%	0.21%	

Table 4: Showing the p-values of p-possum and possum in predicting mortality as observed p value of p-possum is significant than possum in predicting mortality.

	Area Under the Curve	Cut off	P value	Asymptotic 95% Confidence Interval	
				Lower Bound	Upper Bound
PP MORT	.039	38.05	.03 (S)	.000	.115
P. MORT	.809	4.85	.145	.616	1.000

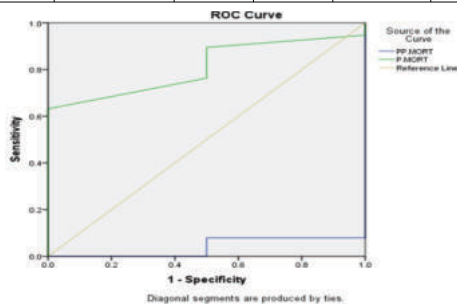


Fig3: ROC curve showing the significance of p-possum and possum

DISCUSSION

The importance of surgical audit has increased over the past years both, as a means of assessing the quality of surgical care and as an educational process. In this era, the use of crude mortality rate can be misleading. A risk adjusted POSSUM was proposed to overcome these shortcomings. In a developing nation like India, due to poverty and ignorance, the presentation of a particular illness is delayed leading to an increased number of complications and high death rates. The use of POSSUM scoring system can identify those patients who are at increased risk of death or complications. However, it has to be correlated to the general condition of the local population to be more precise. Numerous scoring systems have been developed such as ASA (American Society of Anaesthesiologist)⁵ for general risk prediction, APACHE III (Acute Physiology and Chronic Health Evaluation III)⁶ for intensive care, Goldman Index⁷ for cardiac related complications peri-operatively and ACPGBI (Association of Colo Proctology of Great Britain and Ireland)^{8,9}. These scoring systems have provided an objective assessment of patients' health and therefore a meaningful comparison can be made.

For general surgical procedures, POSSUM and its subsequent modifications incorporate physiological, operative and pathological information and provide a comparison of outcomes between surgeons, units and healthcare systems^{10,11}. POSSUM was developed by Copeland et al¹³, from a cohort of 1372 patients in 1991 mainly for surgical audits. It is a scoring system based on 12 preoperative physiological factors and six operative factors. Each factor is scored with 4 graded score values; the sum of individual scores was used to predict 30 days' postoperative morbidity and mortality after deriving equations from logistic regression analysis³. The P-POSSUM is a modification of POSSUM, which incorporates the same variables and grading system, but uses a different equation, which provides a better fit to the observed mortality rate¹¹. It has already been used in general⁴, vascular¹²⁻¹⁵, colorectal¹⁶⁻¹⁸, oesophageal¹⁹ and laparoscopic²⁰ procedures. However, the studies mostly have been done in developed countries where patient characteristics, presentation and hospital resources differ from our setup²¹. Hence, there is a need to validate POSSUM in Indian scenario where problems like delayed presentation and limited resources can affect the outcome even with adequate quality care²²⁻²⁴.

In this study, the validity of POSSUM scoring system in 40 patients undergoing emergency laparotomy for perforation peritonitis in a single surgical unit was assessed by comparing the observed and expected mortality and morbidity rates. 2 patients died; a crude mortality rate of 5%. The most common cause of perforation was enteric perforation 45% followed by peptic perforation 40%. Quersshi²⁵ conducted a similar study on 126 and found similar results with small bowel perforation being 29.4% followed by peptic perforation 24.6%. The difference in percentage being due to difference in sample size. In this study post-operative complications were also seen and it was found that the most common complication observed was wound infection i.e.,47.5%. Yeboah²⁶ conducted a similar study and found similar result with wound infection being the most common morbidity observed i.e.,52.4%. The current study had a observed to examined ratio(O/E) as 0.97 and 1.08 in terms of morbidity and mortality respectively and thus P-POSSUM was found to be a good morbidity and mortality indicator in our current study. D Choubey et al conducted a similar study and found the O/E ratio to be 0.82 in terms of morbidity. However, in the study by D Choubey²⁷ P-POSSUM over-predicted the mortality, also in the previous study of Wakabayashi P-POSSUM over predicted mortality as the study was done in elderly patients planned for elective gastrointestinal surgery for malignant tumour. However, if a surgical unit makes appropriate calculations using its own patient series and updates these equations, the POSSUM system can be useful in the risk assessment for surgery in elderly patients²⁸. In terms of comparison between P-POSSUM and POSSUM for predicting mortality P-POSSUM was found to have a better p-value i.e.,0.03. Lam et al conducted a similar study and found similar results with p-value of 0.055²⁹.

CONCLUSION:

A small sample size is the limitation of this study. However, findings of our study suggest that P-POSSUM scoring system can be used as a tool to predict the mortality and morbidity of patients operated for perforation peritonitis. Strict vigilance and prompt correction of the validated factors can improve the general condition of the patient and decrease the mortality and morbidity. Studies with larger sample size can further validate this scoring system. In addition, general awareness, early referrals, early diagnosis and timely treatment need to be implemented to reduce the perforation to operation time duration and control the co-morbidities.

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