

Accuracy of POSSUM Scoring System in Predicting Mortality and Morbidity in Patients of Perforative Peritonitis

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ABSTRACT

BACKGROUND

Peritonitis developing as a result of hollow viscus perforation is a common condition in a developing country like India. Even if the patient reaches the hospital in time and is operated, the postoperative period is still unpredictable. Secondary peritonitis is the consequence of contamination of the peritoneal cavity due to contents of a hollow viscus within the peritoneal cavity. As peritonitis following hollow viscus perforation is a life threatening condition commonly encountered in our hospital, a uniform scoring system is good to judge the efficacy of the health care as well for prognostic purposes. It helps in selecting patients at high risk who may require intensive management. Thus there has been a search for accurate risk scoring system that can be used to compare patient's outcome. POSSUM scoring system with its 12 physiological score and 6 operative score was used to predict the expected morbidity and mortality.

METHODS:

The present study was a cross sectional study where cases diagnosed as perforative peritonitis undergoing laparotomy in the Department of Surgery, RIMS, Imphal, Manipur, India were studied.

RESULTS

Out of the 100 patients in the study, 5 died and 28 had some form of morbidity. There were no patients with predicted morbidity score of less than 25. The minimum score is 6 and maximum is 48.

CONCLUSIONS

POSSUM scoring is a good tool to predict morbidity and mortality in patients undergoing laparotomy following hollow viscus perforation provided risk stratification is done.

KEYWORDS

Peritonitis, Hollow Viscus Perforation, POSSUM Score, Mortality, Morbidity

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BACKGROUND

The prediction of complications in a high-risk patient is an essential part of risk management in surgery. Peritonitis developing as a result of hollow viscus perforation is a common condition in a developing country like India. Even if the patient reaches the hospital in time and is operated, the postoperative period is still unpredictable. Secondary peritonitis is the consequence of contamination of the peritoneal cavity due to contents of organ within the peritoneal cavity. Most of the Peritonitis are attributed to perforation of stomach, duodenum, small intestine, appendix and colon.¹ Outcome of all surgical procedure performed, not only depends on the performance of the surgeon, but it is the clinical status of the patient at the time of surgery, which largely determines the outcome. Current illness, nature and extent of surgical intervention, and co-morbid conditions associated with the patient influences the final outcome. The ability to compare results of surgeries and their outcome has become increasingly important in recent years. Categorizing patients into different risk groups would also help prognosticate the outcome, select patients for intensive care and determine operative risk, thereby helping to choose the nature of the operative procedure, e.g. damage control versus definitive procedure. POSSUM score helps to identify those patients who are at higher risk of developing complications. This study has been undertaken to evaluate Possum as a tool for predicting mortality and morbidity.

METHODS

This study was carried out in the Department of Surgery, Regional Institute of Medical Sciences, Imphal. This was an observational cross-sectional study. Hundred patients who were admitted to the department of Surgery for Perforation peritonitis over a period of two years were included in the study.

Sample Size

Since the prevalence of stomach, duodenal, ileal and colonic perforation is different, prevalence of hollow viscus perforation as a whole is not known. So assuming 50% as prevalence of hollow viscus perforation undergoing emergency laparotomy and taking 10% as absolute allowable error, the sample size was 96 (rounded off to 100).

$$n = \frac{Z^2 P Q}{L^2}$$

Where n= sample size, p= prevalence, L= absolute allowable error, Q= 100- P

$$n = (1.96)^2 \times 50 \times 50 / (10)^2 = 96.04.$$

Inclusion Criteria

All patients with features of peritonitis following hollow viscus perforation, undergoing laparotomy in RIMS, Imphal.

Exclusion Criteria

- Patients managed conservatively.
- Patients with significant immunosuppression (diabetes mellitus, steroid use, retro positive).
- Patients with altered mental status (Head injury, encephalopathy).
- Patients refusing to participate in the study.
- Patients with severe pulmonary and cardiac co-morbid condition.

The POSSUM system is a two part scoring system that includes a physiological assessment and measure of operative severity. The physiological part of the score includes 12 variables, each divided into 4 grades with an exponentially increasing score.^{2,3,4,5} The physiological variables are those apparent at the time of surgery and include clinical symptoms and signs, result of simple biochemical and haematological investigations and ECG changes. If particular variable is not available then a score of 1 is given. The minimum score is 12 and a maximum score of 88 is possible. The operative part of the score includes 6 variables, each divided into 4 grades with an exponentially increasing score.^{2,3,4,5} Once these scores are known, it is possible to estimate the predicted risk for mortality and morbidity using the following equations.

Equations for Prediction

For morbidity- $\text{Log} (R_2/1-R_2) = -5.91 + (0.16 \times \text{physiological score}) + (0.19 \times \text{operative severity score})$.

For mortality- $\text{Log} (R_1/1-R_1) = -7.04 + (0.13 \times \text{physiological score}) + (0.16 \times \text{operative severity score})$.

Where R_1 = predicted mortality, R_2 = predicted morbidity, PS= physiological score, OS is the operative score.

Statistical Analysis

ROC curve was plotted for POSSUM and a cut-off point was found. At this given score the various indices such as true positive, false positive, false negative, true negative were calculated. Using these values the various statistical indices such as Sensitivity, Specificity, Positive predictive value, Negative predictive value, likelihood ratio positive, likelihood ratio negative were calculated.

Ethical Consideration

Prior approval of institutional ethics committee was obtained for the study. Written informed consent was obtained from all patients included in the study.

RESULTS

Maximum numbers of patients of hollow viscus perforations were in the age group of below 60 years (77%), followed by patients in the age group of 61 – 70 years (14%) and then followed by patient in the age group of more than 71 years of age (9%). There were 88 males (88%) as compared to

12 females (12%). The causes of perforation peritonitis in our study are given in table 1.

	Causes of Peritonitis	No. of Patents
1.	Jejunal perforation	75
2.	Gastric perforation	15
3.	Appendicular Perforation	04
4.	Ileal Perforation	04
5.	Jejunal Perforation	02

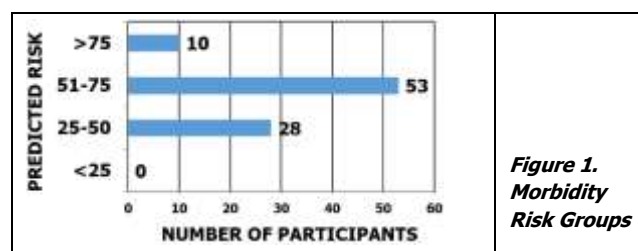
Table 1. Cause of Peritonitis

Physiological and Operative Score

The mean physiological score was 18.47 with a standard deviation of 5.244. The physiological score ranged from 12 to a maximum of 42. The mean operative score was 18.95 with a standard deviation of 1.395, lowest being 13 and highest being 24. The predicted morbidity score ranged from 29.30 to 97.40 with a mean of 62.94 and a standard deviation of 14.64. The predicted mortality score ranged from 5.30 to 69.20. The mean score was 17.85 with a standard deviation of 10.81.

Predicted Morbidity

The participants of the study were divided into 4 groups based on the score of POSSUM predicted morbidity into <25, 25-50, 51-75 and >75.



Out of the 100 patients in the study, 5 died and 28 had morbidity. There were no patients with predicted morbidity score of less than 25.

Morbidity Groups	Number of Patients	Mean Risk	Predicted Morbidity	Actual Morbidity	O:P Ratio
25-50	28	45	13	0	0
51-75	53	64	33	15	0.45
>75	19	85	16	13	0.81
TOTAL	100		62	28	0.45

Table 2. Observed and Predicted ratio of POSSUM

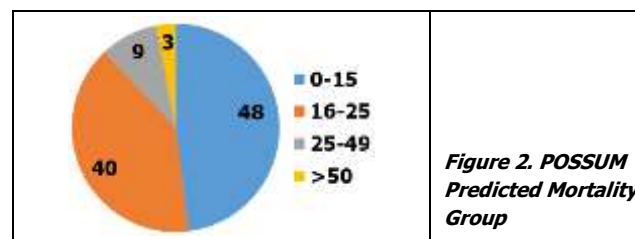
The POSSUM predicted morbidity was 62 whereas the actual morbidity was 28. In the lower risk groups there was over-prediction of morbidity with 46 expected to have morbidity against the observed morbidity of 15. In the higher risk group the predicted number of morbidity was 16 against the actual morbidity number of 13. A ratio of 1.00 indicates good prediction, below 1.00 over-prediction and above 1.00 underprediction.

Observe Mortality Rate

In the present study the numbers of deaths due to perforation peritonitis were 5 and hence the mortality rate was 5%. The risk of mortality by POSSUM was calculated by the following equation:

$$\text{Log} (R_1/1-R_1) = -7.04 + (0.13 \times \text{physiological score}) + (0.16 \times \text{operative severity score}).$$

The POSSUM predicted mortality group was divided into 4 groups based on the POSSUM predicted mortality score from 0-15, 16-25, 26-49 and >49.



The maximum patients were in the range of 0-15 with 48. 40 patients were grouped in 16-25 and 9 in the 26-49. There were 3 patients in the >50 group. The overall observed is to predicted ratio was 0.26. The expected death was over-predicted in the lower risk group. In the higher risk groups the predicted and observed was better.

Mortality Groups	No. of Patients	Mean Risk	Predicted Mortality	Actual Deaths	O:E Ratio
0-15	48	12.49	6	0	0
16-25	40	19.68	8	0	0
26-49	9	35.08	3	2	0.66
>50	3	60.07	2	3	1.5
Total	100		19	5	0.26

Table 3. Predicted Death and O:E Ratio

DISCUSSION

Males outnumbered females by 7: 1 in the present study. In 90 cases the perforation was in the stomach (15) and duodenum (75). Of the 4 appendicular perforation cases, all were in the lower age group. 2 cases of jejunal perforation were there in the study group and both of them were young males and the cause of perforation was trauma. Primary repair was done in all the cases and there was no need for resection and anastomosis. In the present study it was observed that POSSUM over predicted morbidity in the lower risk groups with an O:P ratio of 0.45. The prediction became better in the higher risk group with an O:P ratio of 0.81. The overall O: P ratio was 0.45 with predicted number being 62 and actual morbidity being 28. Most common complication found was surgical site infection. There was one case of kidney failure and two cases of burst abdomen.

Yosif SMA et al⁶ in their study found that POSSUM over-predicted morbidity. The predicted and observed number was 80 and 34 respectively in their study with O: P ratio of 0.43 which is almost similar to the present study. Kumar S⁷ in his study found that there was over prediction in the lower risk group which becomes better with higher risk groups. The POSSUM predicted mortality was 28 and the actual numbers of death was 5 in the present study. The observed is to predicted mortality was 0.26, which indicates over-prediction. Again the predicted mortality was higher in the low risk groups as seen in the predicted morbidity with predicted being 14 and observed 0. The predicted mortality

was better in higher risk groups, with both predicted and observed being 5.

Kitara DL et al⁸ in their study found that mortality prediction was correct in only 18.2%. The same study found that morbidity prediction was very less. Elias ACGP et al⁹ in a study conducted in Brazil which concluded that POSSUM score overestimated the general risk of patients, more so in the higher risk groups. In our study the higher risk groups were predicted better with lower risk groups having over-prediction. Ozman M et al¹⁰ in their study concluded that POSSUM scoring obtained from a heterogeneous population was a successful audit tool, but in low risk groups, it overestimated the mortality rate. Moreover they reported that predictive value of POSSUM for morbidity was affected by the type of surgery and the sample size of the study.

Batra P et al¹¹ in a study 157 patient of perforation peritonitis found a mortality rate of 5.7% which is similar to our study where the mortality rate was 5%. Moreover in the study the overall O: P ratio obtained was 0.2. There was over prediction in the lower risk group which improved in the higher risk groups. Vishwani A et al¹² in their study found that POSSUM overestimated both the morbidity and mortality in low risk groups. The expected mortality was 21 and the observed was 6, giving a O:P ratio of 0.28. Chieng TH et al¹³ in a study conducted in Malaysia with a sample size of 381 patients found that POSSUM over-predicted mortality. The O:P ratio of the study was 0.366.

POSSUM is a good tool for risk-adjusted surgical audit, however, the mechanism of calculation i.e. the exponential method is cumbersome way of analysing a group of patients.

CONCLUSIONS

POSSUM scoring is a good tool to predict morbidity and mortality in patients undergoing laparotomy following hollow viscus perforation provided risk stratification is done. If no risk stratification is done it over predicts both the morbidity and mortality. Even after risk stratification the predicted morbidity and mortality are on the higher side in the low risk groups. The prediction of both morbidity and mortality in this study was good in high risk groups.

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