



**RISK-ADJUSTED ANALYSIS OF PATIENTS UNDERGOING EMERGENCY
LAPAROTOMY USING POSSUM AND P-POSSUM SCORE**

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INTRODUCTION

Over the past few decades, patient outcome has been used as an indicator of patient quality of care, in both developed and developing countries.^[1,5,6,10,11] Risk-adjusted analyses are crucial in order to allow comparison of outcomes between surgeons, hospitals, countries and case-mix, which could affect the outcome of a surgical procedure.^[1,7] POSSUM (Physiological and Operative Severity Score for the enumeration of Mortality and morbidity), which was developed in 1991, mortality which did not significantly differ from observed rates.^[1] The ratio of observed to predicted number of adverse outcomes (O/P ratio) has therefore been used to assess differences between surgeons, units, hospitals and countries.^[7] A ratio of 1.00 would indicate average performance; greater than 1.00, worse than expected, and less than 1.00, better than expected.⁷ The original POSSUM equation over-predicted mortality in low risk patients and under-predicted it in elderly or emergency patients.^[2,4,14] P-POSSUM (Portsmouth modification) was formulated to correct this.^[2,9] The same variables were used but a different regression equation and constant was employed to calculate the mortality risk.^[9] However, it has its own limitations, significantly under-predicting death in the elderly^[13,15] as well as in emergencies.^[14] POSSUM has been found to accurately predict 30-day morbidity and mortality for a wide range of elective and emergency general surgical procedures, even though it cannot replace highly specific scoring systems for individual disease states.^[1,6,7,9,10,11,12] However, when initially developed, POSSUM did not include patients undergoing surgery for trauma.^[1,8] Surgical patients often require intensive care unit (ICU) admission, and the unique characteristics of these patients have resulted in targeted systems to guide such admissions as well as predict outcome. Probably the best known and most widely used system is APACHE.^[6,9] Unfortunately, its complexity and exclusion of operative factors renders APACHE less useful in the evaluation of surgical patients compared with POSSUM and PPOSSUM.^[8,16,17] Other scoring systems have also been shown to indirectly correlate with surgical outcome. For instance, post-operative mortality rises with ASA (American Society of Anesthesiologists) grade, but although simpler to use than APACHE, it again does not include operative factors other than emergent statuses.³The primary aim of this study was to assess the overall predictive value of POSSUM for morbidity and mortality compared with P-POSSUM in patients undergoing laparotomy in S.S.G. Hospital, Vadodara, a referral centre in a developing country.

MATERIALS AND METHODS

All patients aged over 18 years undergoing emergency general surgical laparotomy from 1st February to 30th October 2014 were prospectively included. Approval from the hospital director was obtained before starting this study in the presence of an ethics committee in this hospital. Data collected included demographics, surgical parameters and outcomes of patients.

The physiological components recorded were measured as close to the time of the planned laparotomy as possible. The operative severity component was completed after laparotomy. Patients were followed up for 30 days post-laparotomy to document morbidity and mortality.

POSSUM and P-POSSUM score was calculated the predicted mortality and morbidity by using the regression equation respectively.

Observed / Predicted (O/P ratio) for mortality and morbidity based on POSSUM and P-POSSUM was then obtained. P values were calculated and $p < 0.05$ were considered statistically significant using SPSS version.^[15]

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

$\text{Log} (R_1 / (1 - R_1)) = -7.04 + (0.13 \times \text{physiological Score}) + (0.16 \times \text{operative severity score})$. Statistical data analysis was done using the SPSS version 10.0 software. A student t-test was used to compare significant differences and chi-square/Fisher's exact test was used in testing association of categorical variables. The quality control was ensured by making the principal investigator carryout all the pre-operative and postoperative assessment, clinical examinations and measurements of parameters using standard SI units to avoid inter-observer error. Laboratory investigations were done by the same method and in standard unit.

RESULTS

A total of two hundred and seventy three major surgical laparotomy were performed between February 2014 to October 2014. Two hundred and seventy three major surgical laparotomy were available for final analysis.

Table 1

Sr. No.	Indication	No. of Cases	Percentage
1.	Gastric perforation (Pyloric/Pre-Pyloric)	117	43.33
2	Duodenal perforation	9	3.30
3	Small intestine perforation	37	13.70
4	Appendicular perforation	12	4.40
5	Intestinal Obstruction	53	19.30
6	Malignancy	10	3.70
7	Obstructed hernia	07	2.50
8	Trauma	16	5.90
9	Others	09	3.30
	Total	270	100

Outcome of surgery

Of the 273 procedures studied, 56 (20.74%) of them were associated with death of the patient.

Observed: Expected Mortability Rate (According POSSUM)

Comparison of observed & POSSUM mortality rate was done using linear analysis. An observed to expected ratio (O:E) of 0.96 was obtained and there was no significant difference between the predicted and observed values ($\chi^2=4.69$ d.f=9, $p=0.0303$)

Observed: Expected Mortability Rate (According P-POSSUM)

Comparison of observed & P-POSSUM mortality rate was done using linear analysis. An observed to expected ratio (O:E) of 0.96 was obtained and there was no significant difference between the predicted and observed values ($\chi^2=8.67$ d.f=9, $p=0.003$)

Observed: Expected Morbidity Rate

Comparison of observed & POSSUM morbidity rate was done using linear analysis.

Predicted Morbidity Rate (%)	No. of Procedure	Observed No. of Complication (O)	Expected No. of Deaths (E)	Ratio (O/E)
<=10	0	0	0	0.00
10 to 20	0	0	0	0.00
20 to 30	0	0	0	0.00
30 to 40	3	0	1	0.00
40 to 50	15	0	4	0.00
50 to 60	68	7	15	0.47
60 to 70	71	4	15	0.27
70 to 80	14	2	3	0.67
80 to 90	82	34	17	2.00
90 to 100	17	9	4	2.25
Total	270	56	59	0.95

DISCUSSION

The basic tenet in medical care has been to provide quality care to the patient to cause reduction in adverse outcome. It is by comparing the adverse outcome rates that we can assess the adequacy of care provided to the patient and evolve new treatment strategies. However, comparison using crude mortality rates can be misleading as it cannot adequately account for the patient's general condition and the disease process for which he was subjected to surgery. To overcome this shortcoming POSSUM, a risk adjusted scoring system was proposed⁵. P-POSSUM, a modification of POSSUM, has been proposed as a better scoring system as it better correlates with the observed mortality rate.^[7,8] But P-POSSUM has to be correlated to the general condition of the local population for it to be effective.^[7,8,14,15,19,21] This is especially true in patients in developing countries like India where the general health of the population is poor, malnutrition is a common problem and presentation frequently delayed.^[19,20,21] In our study we assessed the validity of POSSUM & P-POSSUM in 270 major general surgeries by comparing the observed mortality rate with expected mortality rate. 56 patients died 20.7% (the total crude mortality rate being 20.7%).

CONCLUSION

We studied 270 major general surgeries, emergency cases, which resulted in 56 deaths (20.7% mortality rate). On applying POSSUM & P-POSSUM we found that the expected number of deaths for our study group was 58 (O: E = 0.97) also on applying POSSUM we found that the expected number of deaths of our study was 58 (O: E = 0.97).

We found no difference between expected and observed mortality rates. The present study suggests that both POSSUM and P-POSSUM are accurate scoring system

for predicting postoperative adverse outcome among patients undergoing major general surgeries.

The complications of wound infection (73.33%) and chest infection (35.5%) are a concern and require better care for their prevention following major general surgeries. All the studied risk factors were found to have a positive rate of increment of deaths with higher scores. Presence of total blood loss, serum sodium levels and blood urea levels and leukocytosis were found to be significant in our study. Hence adequate and prompt correction of these factors could decrease the mortality rate.

This study therefore validates POSSUM & P-POSSUM as a valid means of assessing adequacy of care provided to the patient. P-POSSUM can be used for surgical audit to assess and improve the quality of surgical care and result in better outcome to the patient.

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