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Original research article

P-POSSUM IN PREDICTING DEATH IN PATIENTS UNDERGOING EMERGENCY LAPARATOMY

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Abstract

P-POSSUM is a simple scoring system, described and validated in developed countries like UK. A total of 150 emergency laparotomies were performed. The risk of complication and death was calculated using P-POSSUM equations. The estimated rates were compared with observed rates using both linear and exponential methods of analysis. P- POSSUM of the linear method predicted accurate number of deaths (19 patients) with O:E ratio of 1. When exponential method used it predicted similar number of deaths (20 patients) with O:E ratio of 0.95 with no significant difference.

Keywords: P-POSSUM, morbidity, mortality

Introduction

POSSUM (Physiological and operative severity score for the enumeration of mortality and morbidity) was first described by Copeland *et al*. 5 in 1991 as a method for standardizing patient's data so that direct comparisons of patient outcome could be made despite differing patterns of referral and population.6 They originally assessed 48 physiological factors and 14 operative and post operative factors for each patient. Using multivariate analysis techniques these were reduced to 12 physiological and 6 operative factors [1].

The POSSUM is a 2 part scoring system that includes a physiological assessment and a measure of operative severity. The physiological part of the score includes 12 variables, each divided into 4 grades with an exponentially increasing score (1, 2, 4 and 8). The physiological variables are those apparent at the time of surgery and include clinical symptoms and signs, results of simple biochemical and hematological investigations, and electrocardiographic changes. Highest score being given to the most deranged values. If a particular variable is not available, a score of 1 is allocated. Some variables may be assessed by means of clinical symptoms or signs or by means of changes on chest radiographic findings. The minimum score, therefore, is 12, with a maximum

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score of 88 [2, 3].

The POSSUM physiology score based on these preoperative factors was predictive of outcome for individual operations, but not for groups of surgical patients as a whole. For example, a patient having an aortic aneurysm repair was likely to have a higher probability of death than the same patient having a pilonidal abscess drained. To address this, a six-factor operative severity score was added using similar methodology [4].

POSSUM scores derived from the physiological values is a measure of pre-operative severity of illness. POSSUM has the advantage of including operative severity variables, which made it better in predicting morbidity and mortality rates [5].

The operative severity part of the score includes 6 variables, each divided into 4 grades with exponentially increasing score (1, 2, 4 and 8). The number of operations indicates the chronology of the procedure(s) within 30 days [5].

Methodology

Data was collected prospectively on a proforma prepared for the study from the patients undergoing emergency laparotomy. All such patients would have their physiological score recorded on admission. An operative severity score was calculated based on findings recorded by the operating surgeon on the proforma.

P-POSSUM equation for mortality

Log R/1-R = - 9.065 + (0.1692 x physiological score) + (0.1550 x operative severity score).

R = risk of mortality.

Postoperative morbidity and death in the hospital was recorded in accordance with definitions described previously. A total of 150 cases were included in the study.

Study Period: Sept 2023 to Dec 2023

Inclusion criteria

Patients undergoing emergency laparotomy.

Exclusion criteria

Age of patients < 12 yrs.

This study got ethical Clarence from Institutional Ethical Committee

Results

Table 1: Linear Analysis for *P. possum*

Mortality group (%)	Number of patients	Actual deaths	Predicted*	O: E
< 10	94	4	5	0.8
10-19	24	3	4	0.75
20-29	18	5	4	1.25
30-39	9	5	3	1.66
40-49	2	0	1	0.00
50-59	1	0	1	0.00
60-69	2	2	1	2.00

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70-79	0	0	0	0.00
80-89	0	0	0	0.00
> 90	0	0	0	0.00
0-100	150	19	19	1.00

χ^2=3.198 d.f = 6 P = 0.784 (NS).

*Rounded to nearest value.

Table 2: Exponential Analysis for P-Possum

Mortality group (%)	Number of patients	Actual deaths	Predicted*	O: E
0-19	118	7	12	0.58
10-19	24	3	2	1.50
20-49	29	10	6	1.66
30-49	11	5	3	1.66
40-49	1	0	1	0.00
50-100	3	2	2	1.00
60-100	2	2	1	2.00
70-100	0	0	0	0.00
80-100	0	0	0	0.00
90-100	0	0	0	0.00
0-100	150	19	20	0.95

χ^2 = 0.029 d.f = 1 P = 0.864 (NS).

*Rounded to nearest value.

Discussion

Mohil RS *et al*. [7] compared POSSUM and P-POSSUM for predicting the adverse outcome rate in patients undergoing emergency laparotomy. They concluded by validating POSSUM and P-POSSUM scoring systems for accurate prediction of post operative mortality rates even in the Indian scenario, where the patients usually belonged to the low socioeconomic strata with very limited resources.

Sagar PM *et al*. [8] evaluated feasibility of POSSUM scoring system for predicting adverse outcome rate following colorectal resection and its use for comparative audit. They concluded by validating POSSUM scoring system in patients undergoing colorectal surgery and also its efficacy in comparative audit.

Yii MK, Ng KJ9 evaluated the POSSUM scoring system in a developing country, the observed mortality rates of 605 patients undergoing general surgical procedures were compared with predicted mortality rates by POSSUM and P-POSSUM. The authors observed mortality rate of 6.1 in hospital. POSSUM overpredicted mortality whereas P-POSSUM predicted comparable mortality rate. They concluded that the POSSUM scoring system with the modified P-POSSUM predictor equations for mortality was applicable in developing country like Malaysia. This scoring system may serve as useful comparative audit tool in many geographical locations.

Zafirellis KD *et al*. [10] tested the applicability of POSSUM scoring system for assessing mortality rates in patients of oesophageal cancer, undergoing oesophagectomy and concluded the POSSUM does not accurately predict mortality and morbidity in patients undergoing oesophagectomy and must be modified.

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Wijesinghe LD *et al*. [11] compared POSSUM and the Portsmouth predictor equation for predicting death following vascular surgery, the predicted deaths of 312 patients undergoing vascular surgery were compared with observed mortality rates. The observed predicted (O:E) mortality ratios were calculated by two methods (Linear and exponential) for each of the scoring systems. They concluded that the O:E ratios for POSSUM and P-POSSUM were close to unity when the appropriate analysis was performed. Both POSSUM and P-POSSUM overpredicted death if the incorrect analysis was used.

Jones DR, Copeland GP, De Cossart L [12] compared POSSUM with APACHE II for prediction of outcome from a surgical high dependency unit, the POSSUM and APACHE II scores from 117 consecutive admissions, after major surgery were correlated with 30 day observed mortality and morbidity rates. The receiver-operating characteristic curve analysis of their study showed POSSUM to have good predictive value for mortality (area under curve 0.75) and morbidity (area under curve 0.82).

APACHE II scores had a significantly inferior predictive value for mortality (area under curve 0.54) ($P < 0.002$). The authors concluded that the POSSUM was superior to APACHE-II in prediction of mortality and postoperative complications and may be used for audit.

Copeland GP [13] analyzed POSSUM methodology in general surgical setting, the author opined that POSSUM system had added advantage of accounting for major differences in case mix and also produced a risk adjusted assessment of a mortality and morbidity, development of such risk adjusted outcome analysis the methodology exists to examine quality of care in a more systematic way.

Midwinter MS, Tytherleigh M, Ashley S [14] evaluated the use of POSSUM methodology in 221 patients undergoing elective and emergency arterial surgery under a single consultant, the observed morbidity and mortality rates were compared with the rates predicted by POSSUM and P-POSSUM using a linear method of analysis. They observed POSSUM predicted risk of morbidity which was not significantly different from the observed complication rates. POSSUM equation for mortality over predicted mortality, but mortality rate estimated by P-POSSUM was not significantly different from the observed death rates. The authors concluded that the POSSUM methodology combined with P-POSSUM adjustment for death allows satisfactory prediction of mortality and morbidity rates in patients undergoing vascular surgery.

Lai F *et al*. [15] tested the use of the POSSUM, P-POSSUM in 545 patients undergoing elective thoracic oesophagectomy, the authors observed in hospital mortality rates and were compared with rates predicted by POSSUM, P-POSSUM and O-POSSUM and were assessed using receiver-operation characteristic (ROC) curve analysis. They observed that POSSUM and O-POSSUM showed lack of fit against observed mortality, whereas P-POSSUM showed no lack of fit. They concluded that the P-POSSUM provided the most accurate prediction of in-hospital mortality rate.

Conclusion

The P-POSSUM equation predicted similar rates when correct linear method of analysis was used, but to the contrary it also predicted similar deaths when exponential method of analysis was used which can be explained because of small sample size. Our results show that, when correct method of analysis is used the scoring systems are valid in this group of patients in our hospital setup.

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