

ORIGINAL RESEARCH

A study of POSSUM in predicting complications in patients undergoing emergency laparotomy

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ABSTRACT

POSSUM (Physiological operative severity score for enumeration of mortality and morbidity) is a simple scoring system, described and validated in developed countries like UK. Application of POSSUM to developing countries, with a different population and level of resources is limited. A total of 150 emergency laparotomies were performed. The risk of complication and death was calculated using POSSUM. The estimated rates were compared with observed rates using both linear and exponential methods of analysis. POSSUM over predicted complication when linear method is used i.e. 103 patients against 75 patients with complications O:E ratio of 0.72. When exponential method is used, it predicted near similar values 67 patients against 75 patients observed with O:E ratio of 1.11 with no significant difference. A total of 19 deaths observed. POSSUM with linear method of analysis over predicted deaths (37 patients) with O:E ratio of 0.51, whereas with exponential method it calculated similar number of deaths (20 patients) with O:E ratio of 0.95 with no significant difference.

Key words: POSSUM, morbidity, mortality

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INTRODUCTION

Risk scoring systems should quantify a patient's risk of death or morbidity based on the severity of illness derived from data available at an early stage of the hospital stay. It is currently of particular importance in surgical practice ¹.

Many scoring systems were developed that predict the risk of mortality with varying degrees of accuracy. Many scores have been devised which are ideally suited to special types of surgical procedure or to assessing particular types of complications. The ideal scoring system for the surgical audit purposes should assess mortality and morbidity and allow audit retrieval of surgical success. It should be quick and easy to use and should be applicable to all general surgical procedures in both the emergency and elective setting. It should be of use in all types of hospitals and should provide educational information ².

With this in mind a system was developed to allow for the first time an assessment of surgical quality that was risk adjusted for the patient's acute and chronic physiological status and for the nature of operation. By using a process of multivariate discriminant analysis, a scoring system was developed that could accurately predict 30 day mortality and morbidity. The POSSUM audit system (The physiological and operative severity score for enumeration of mortality and morbidity) was designed to be easy and rapid to use and to have wide application across the general surgical spectrum both in the elective and emergency settings ^{3,4}.

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.

STUDY PERIOD: Sep 2023 to Dec 2023.

POSSUM EQUATIONS

1. $\text{Log R1/1-R1} = -7.04 + (0.13 \times \text{physiological score}) + (0.16 \times \text{operative severity score})$.
2. $\text{Log R2/1-R2} = -5.91 + (0.16 \times \text{physiological score}) + (0.19 \times \text{operative severity score})$.

INCLUSION CRITERIA

Patients undergoing emergency laparotomy.

EXCLUSION CRITERIA

Age of patients < 12 yrs.
This study got ethical Clearance from Institutional Ethical Committee.

R1 = risk of mortality R2 = risk of morbidity.

RESULTS

Table 1: Linear Analysis for Possum

Mortality group (%)	Number of patients	Actual deaths	Predicted*	O:E
< 10	32	0	2	0.00
10-19	43	2	6	0.33
20-29	32	1	8	0.12
30-39	7	1	2	0.50
40-49	19	5	9	0.55
50-59	7	3	4	0.75
60-69	8	5	5	1.00
70-79	2	2	1	2.00
80-89	0	0	0	0.00
> 90	0	0	0	0.00
0-100	150	19	37	0.52

$\chi^2 = 6.25$ d.f = 7 P = 0.510 (NS).

*Rounded to nearest value.

Table 2: Exponential Analysis for Possum

Mortality group (%)	Number of patients	Actual deaths	Predicted*	O: E
0-39	114	4	6	0.66
10-39	82	4	8	0.50
20-39	7	1	2	0.50
40-100	36	15	14	1.07
50-100	17	10	9	1.11
60-100	10	7	6	1.16
70-100	2	2	1	2.00
80-100	0	0	0	0.00
90-100	0	0	0	0.00
0-100	150	19	20	0.95

$\chi^2 = 0.029$ d.f = 1 P = 0.864 (NS)

*Rounded to nearest value.

Table 3: Morbidity Analysis Possum Linear Method

Morbidity group (%)	Number of patients	Observed morbidity	Predicted*	O: E
< 10	0	0	0	0.00
10-19	1	0	1	0.00
20-29	9	0	2	0.00
30-39	7	1	2	0.50
40-49	16	0	7	0.00
50-59	12	3	7	0.42
60-69	25	10	16	0.62
70-79	26	19	20	0.95
80-89	26	25	22	1.13
> 90	28	17	26	0.65
0-100	150	75	103	0.72

$\chi^2 = 11.29$ d.f = 8 P = 0.18 (NS)

*Rounded to nearest value.

Table 4: Morbidity Analysis Possum Exponential Method

Morbidity group (%)	Number of patients	Observed morbidity	Predicted*	O: E
0-49	33	1	8	0.12
10-49	33	1	3	0.33
20-49	32	1	6	0.16
30-49	23	1	7	0.14
40-49	16	0	6	0.00
50-100	117	74	59	1.25
60-100	105	71	63	1.12
70-100	80	61	56	1.08
80-100	54	42	43	0.97
90-100	28	17	25	0.68
0-100	117+33 = 150	74 + 1 = 75	59 + 8 = 67	1.11

$$\chi^2 = 0.86 \text{ d.f} = 1 \text{ P} = 0.35 \text{ (NS).}$$

*Rounded to nearest value.

DISCUSSION

The POSSUM equation predicted 37 deaths using linear method of analysis, with O:E ratio of 0.51 ($\chi^2 = 6.25$ d.f.7 P = 0.510) R.S. Mohil RS *et al.*⁵ in their prospective study showed that POSSUM with linear analysis significantly overpredicted death ($\chi^2 = 18.16$, d.f.9., P = 0.011) with an O: E of 0.39 as in our study. When correct method of analysis as described by Copeland *et al.*⁶ i.e., exponential method of analysis was used the POSSUM predicted similar number of deaths as observed with O:E ratio of 0.95 with no significance of difference.

M.K Yii, K.J. Ng⁷ in the prospective study showed that POSSUM over predicted deaths when linear method of analysis was applied whereas P-POSSUM predicted similar number deaths with no statistical significance.

The P-POSSUM when analysed using linear analysis predicted deaths exactly similar to observed with O: E of 1 with no statistical significance of difference. On the contrary P-POSSUM also predicted similar number of deaths when used with exponential type of analysis with O: E of 0.95 with no significance of difference.

POSSUM equation for morbidity over predicted complication rate (103 patients) when linear method of analysis was used, with O: E ratio of 0.72. When exponential method of analysis used it predicted near similar number of complications (67 patients) as compared to observed with O:E ratio of 1.11. Vollmer CM *et al.*⁸ in their prospective study POSSUM predicted 51 patients with complications against observed 41 patients with complications with O:E ratio of 0.81 which was similar to our study.

The predictive power of the two equations is related to the statistical method used for analysis.

The POSSUM scoring developed by Copeland *et al.*⁶ uses exponential method of analysis whereas the P-POSSUM uses linear method of analysis.

In the present study POSSUM equation clearly overpredicted mortality when linear method of analysis was used, but the mortality calculated by exponential method of analysis was similar to the

actual rate. It implies that if incorrect method of analysis is used it gives false reports.

CONCLUSION

POSSUM equation of morbidity, estimated complications comparable to observed rates when correct method i.e., exponential method of analysis is used. If this finding is validated on the larger data set it may be possible to use POSSUM scoring system to improve the emergency services.

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