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EVALUATION OF P - POSSUM SCORING SYSTEM IN PATIENTS UNDERGOING EMERGENCY LAPAROTOMY IN BPKIHS

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ABSTRACT

Introduction: The Physiological and Operative Severity Score for the enumeration of Mortality and morbidity (POSSUM) and its modification the Portsmouth POSSUM (P-POSSUM), have been proposed as a method for standardizing patient data so that direct comparisons can be made despite differing patterns of referral and population. In this prospective study, the validity of P-POSSUM was tested in patients undergoing emergency laparotomy and the risk factors for low outcome were noted. **Methods:** This is the Prospective Study and was conducted in Department of surgery of a tertiary level hospital. The study period was from February 2021 – July 2021 for 6 months. Patients admitted under department of general surgery scheduled to undergo emergency laparotomy were included and scored according to their physiological and operative findings using a proforma sheet. Patients were followed-up for the first 30 days postoperative period. The observed mortality rate was compared with the P-POSSUM predicted mortality rate. **Results:** A total of 60 patients who met the inclusion criteria were included in this study. On applying linear analysis, an observed to expected ratio was obtained, indicating a significant fit for predicting the post-operative adverse outcome. There was no significant difference between the observed and predicted mortality rates ($x2 = 12.754$, $df= 9$, $P = 0.174$). In all the risk factors studied except malignancy, pulse rate, respiratory system and the age of the patients, a positive correlation was found between deaths and higher POSSUM scores. **Conclusion:** Portsmouth POSSUM scoring system serves as a good predictor of post-operative outcome in emergency laparotomy procedures.

KEYWORDS: POSSUM; surgical scoring; mortality.

INTRODUCTION

Continuous monitoring and auditing of surgical service is very essential in enhancing patient care and gaining quality eventually. Various scoring system (ASA, APACHE, SAPS II)are used to predict postoperative mortality which allows for better individual risk prediction, therapeutic planning and resource allocation, with lower risk of failure.[1,2,3,4] However, the POSSUM (Physiologic and Operative Severity Score for the Study of Mortality and Morbidity) has been commonly recommended as appropriate for surgical practice.[2] It was developed by Copeland et al in 1991 in an effort to normalize patient data so as to allow direct comparisons of patient outcome despite varying patterns of referral and population.[5]

Originally POSSUM used 62 variables, 48 physiological and 14 surgical. After multivariate analysis techniques, these numbers were reduced to 12 physiological variables and 6 surgical. The system seeks to predict morbidity and mortality in the first 30 postoperative days and allows comparing the results within the institution over time or performing a cross-sectional comparative analysis with other institutions.[6] But it was observed that the system overestimated mortality, especially for low-risk patients. Therefore, the P-POSSUM score (Portsmouth Physiologic and Operative Severity Score for the Study of Mortality and Morbidity) was developed, which, despite using the same variables, is able to reduce the overestimation calculated by POSSUM.[3,7] The P-POSSUM is calculated by adding a regression equation to the POSSUM calculation.

P-POSSUM has already found use in general, vascular[8], colorectal[9], esophageal[10] and laparoscopic[11] procedures but the studies mostly involved patients in developed countries, where the patient characteristics, presentation and available resources differ from our setup.[12] Hence, there is a need to test the validity of P-POSSUM scoring system in our population. This study was undertaken to assess the validity of P-POSSUM scoring system in patients undergoing emergency laparotomy in our setup.

METHODS

This was a prospective study conducted in a tertiary level referral hospital of BPKIHS, Dharan, Nepal for a duration of 6 months from February 2021 to July 2021. Every case presenting for emergency laparotomy under general surgery for 6 months period was included in this study after assessment of the inclusion criteria and cases were followed up for 30 days following the surgical procedure. Patients above 15 years of age, both males and females, who underwent emergency laparotomy were recruited for study. Patients unfit for general anesthesia, patients requiring cardiopulmonary resuscitation before surgery, mentally disabled patients; patient less than 15 years of age, patients requiring damage control surgery before definitive treatment and who cannot meet follow up criteria were excluded. Informed written consent was taken prior to inclusion of the individuals into the study. The study protocol was approved by the local ethical clearance committee of the hospital. During hospitalization, relevant history was collected and appropriate investigations as deemed necessary were done using standard procedures. The patients were then scored depending on their physiological and the intra operative findings were noted using a proforma sheet and a final expected mortality rate was calculated. During 30 days follow up period following the surgical procedure and complications if any, were noted depending upon the criteria as defined for POSSUM scoring system. Data obtained was entered in SPSS and analyzed using linear regression analysis and the O: E ratio was calculated to obtain expected mortality rate. Chi-square (x2) test to see the association between POSSUM score and poor outcome. Rate of increment in deaths for each risk factor was calculated based on the hypothesis that deaths were linearly related with the score for each of the studied risk factors and 't' test was applied to validate this hypothesis.

Physiological parameters

	1	2	4	8
Age	**<60**	**61-70**	**>71**	
Cardiac signs Chest radiograph	No failure	Diuretic, digoxin, antianginal or antihypertensive therapy	Peripheral edema, warfarin therapy Borderline Cardiomegaly	Raised jugular venous pressure Cardiomegaly
Respiratory history Chest radiograph	No dyspnea	Dyspnea on exertion	Limiting dyspnea Mild COAD	Dyspnea at rest>30 Fibrosis or consolidation
Blood pressure	110-130	131-170 100-109	>171 90-99	<89
Pulse	50-80	81-100 40-49	101-120	>121 <39
Glasgow coma scale	15	12-14	9-11	<8
Hemoglobin	13-16	11.5-12.9 16.1-17	10-11.4 17.1-18	<9.9 >18.1
White cell count (x 1000)	4-10	10.1-20 3.1-4	>20.1 <3.1	
Urea(mmol/l)	<7.5	7.6-10	10.1-15	>15.1
Sodium (mmol/l)	>136	131-135	126-130	<125
Potassium (mmol/l)	3.5-5	3.2-3.4 5.2-5.3	2.9-3.1 5.4-5.9	<2.8 >6
ECG	Normal		Atrial fibrillation	Any other abnormal rhythm

INTRA-OPERATIVE FINDINGS

	1	2	4	8
Operative severity	Minor	Moderate	Major	Major+
Multiple procedures	1		2	>2
Total blood loss	<100	100-500	501-999	>1000
Peritoneal soiling	None	Minor	Local pus	Free bowel content, pus or blood
Presence of malignancy	None	Primary only	Nodal metastasis	Distant metastasis
Mode of surgery	Elective		Emergency resuscitation of >2h possible, Operation < 24 h after admission	Emergency (immediate surgery <2 h needed)

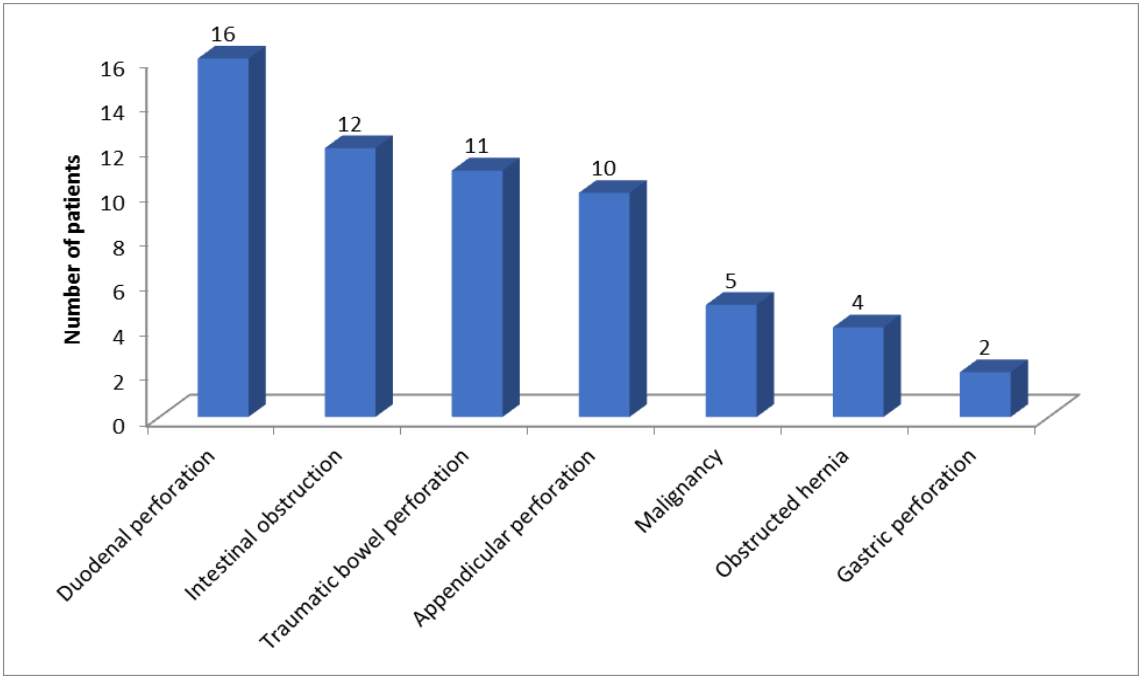
Physiological score (12-88), Operative score (9-44)
For mortality it is,
Loge [R/1-R] = (0.1692 x PS) + (0.155 x OS) - 9.065.
Where R = risk of mortality.

RESULTS

A total of sixty emergency surgical operations were included in study between February 2021 and July 2021. A total of 60 patients who met the inclusion criteria were included in this study. Out of which 38(63%) patients were male and 22 (37%) patients were female. Age of the patient were ranges from 16-79 years. Among them 44 (73.4%) were of <= 60 years, 14 (23.3%) of 61-70 years and 2 (3.33%) were of >70 years. Among 60 patient undergoing emergency laparotomy, 16 patients were operated for duodenal ulcer perforation followed by intestinal obstruction in 12 patients. Other indications were traumatic bowel perforation, appendicular perforation, malignancy, obstructed hernia and gastric perforation in descending sequence (Table 1). The post-operative complications noted during the 30 day follow up period are listed in (Table 2). Among 60 operated cases, 31 patients developed complications. Comparison of observed and P-POSSUM predicted mortality rates was done using linear analysis as represented in (Table 3). An observed to expected ratio (O: E) of one was obtained and there was no significant difference between the predicted and observed outcome was noted (x2 = 12.754, df 9, P = 0.174). We found positive rate of increment with all the risk factors studied except malignancy, pulse rate, respiratory system and age of the patients but it was found to be statistically significant only with respect to electrocardiogram (p = 0.043) as shown in (Table 4).

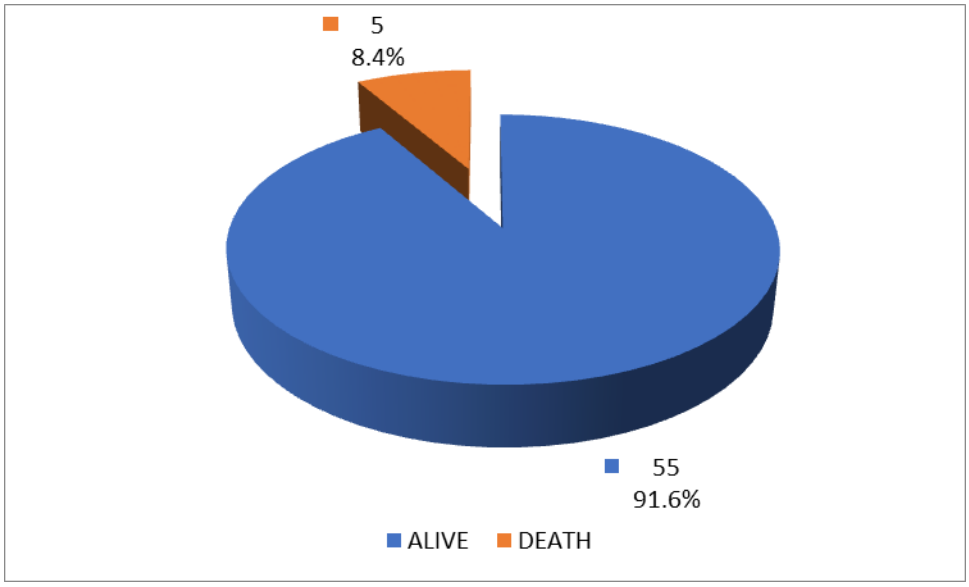
Indications of surgery (Table 1)

S.no.	Indications	No. Of patients
1	Duodenal perforation	16
2	Intestinal obstruction	12
3	Traumatic bowel perforation	11
4	Appendicular perforation	10
5	Malignancy	5
6	Obstructed hernia	4
7	Gastric perforation	2
	Total	60



Outcome of surgery

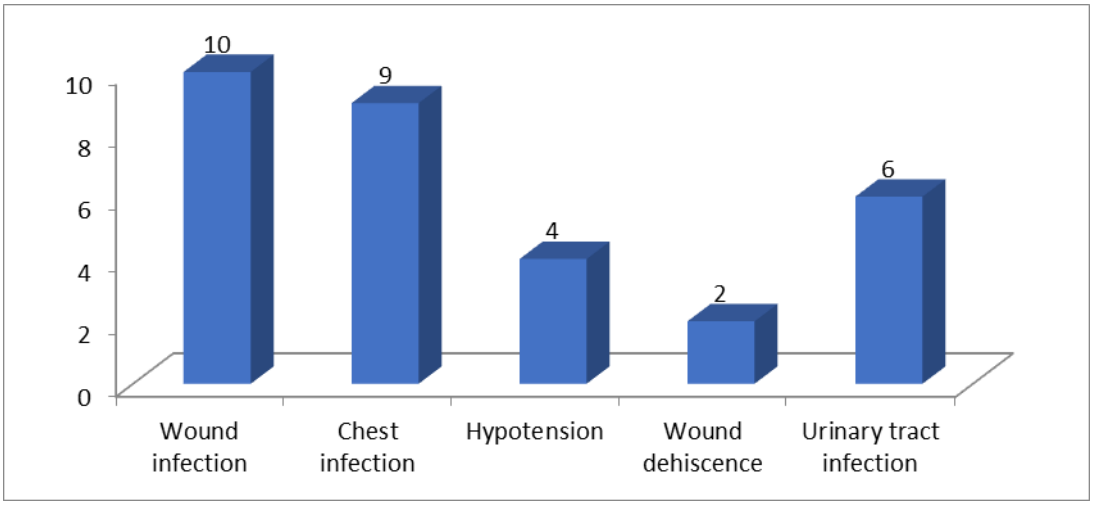
Of the 60 procedures studied, 5 of them were associated with death of the patient resulting in crude mortality rate of 8.33% represented in graph.



Complications

The complications occurring during the 30 day follow up period following the surgeries are listed in table 2.

	Type	No. Of cases
1.	Wound infection	10
2.	Chest infection	9
3.	Hypotension	4
4.	Wound dehiscence	2
5.	Urinary tract infection	6
	Total	31



Observed: Expected mortality rate

Comparison of observed and P-POSSUM predicted mortality rates was done using linear analysis. An observed to expected ratio (O: E) was obtained and there was no significant difference between the predicted and observed values ($x2$ = 12.754, 9 d., P = 0.174).

Comparison of observed and expected mortality rate. O: Observed number of deaths, E: Expected number of deaths, Chi square= 12.754, df= 9, p= 0.174 (Table 3)

Predicted mortality rate %	Number of procedures	Mean Predicted risk	Observed number of deaths	Expected number of deaths	O: E
20-29	44	24.25	2	7.3	0.82
40-49	5	46.40	2	4.6	0.65
60-69	11	64.18	1	10.1	0.99

RISK FACTORS

The analysis of risk factors for low outcome in our study is represented below in table 4.

	Risk factors	Correlation	Rate of increment per score	T	P
1.	Mode of surgery	.316	.146	.939	.353
2.	Malignancy	.329	-.376	-1.830	.075
3.	ECG	.041	.457	2.096	.043
4.	Peritoneal contamination	.628	.085	.536	.595
5.	Total blood loss	.333	.146	.821	.417
6.	Potassium	.230	.092	.625	.536
7.	Sodium	.284	.054	.369	.714
8.	Blood urea	.404	.239	1.373	.178
9.	White cell count	.404	.047	.283	.779
10.	Hemoglobin	.244	.200	1.264	.214
11.	GCS	-	-	-	-
12.	Pulse rate	.441	-.074	-.480	.634
13.	Blood pressure	.265	.092	.621	.538
14.	Respiratory system	-.131	-.001	-.002	.998
15.	Cardiovascular system	-	.205	.745	.461
16.	Age	-.001	-.037	-.199	.843
17.	Multiple surgeries	-	-	-	-

($p < 0.05$ = significant)

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 proposed.

P-POSSUM, a modification of POSSUM, has been proposed as a better scoring system as it better correlates with the observed mortality rate. But P- POSSUM has to be correlated to the general condition of the local population for it to be effective. This is especially true in patients in developing countries like Nepal where the general health of the population is poor, malnutrition is a common problem and presentation frequently delayed. In our study we assessed the validity of P-POSSUM in 60 emergency surgeries by comparing the observed mortality rate with expected mortality rate. 5 patients died (mortality rates of 8.33%). Tekkis and others obtained similar results (elective = 3.9%, emergency 25% and overall mortality rate of 11.1%)15. However, on using P-POSSUM the expected mortality rate was 15 deaths. On analysis, there was found to be no statistically significant difference between the observed and expected mortality rates ($x2 = 12.754$, df= 9, p = 0.174). An O: E ratio of one was obtained in our case which is similar to the findings obtained by Yii MK and Ng KJ19 (O: E = 1.28), Tekkis15 (O: E = 0.98) and Mohil 20(O: E = 0.66, $x2 = 5.33$, 9 d.f., p=0.619). Hence P-POSSUM was able to accurately predict the adverse outcome following major surgery in our study. analyzing the risk factors, we found positive rate of increment with all the risk factors studied except malignancy, pulse rate, respiratory system and age of the patients were found to be negative increment per score but it was found to be statistically significant with respect to the only electrocardiogram (p =0.043). Various factors like decreased immunity and cachexia resulting from malignancy, ischemia and impaired hemostasis resulting from blood loss, uremia resulting in decreased healing rates, impaired immunity, leukocytosis correlating with the degree of inflammation, toxemia, hyponatremia resulting into impaired physiological response could be attributed to the effect of these factors on post operative mortality rate. Therefore, adequate and prompt correction can definitely be expected to cause a decrease in adverse outcome rates.

Tekkis and others found that total blood loss was not significant enough to alter their statistical analysis in their study but their study predominantly involved elective cases (66%) in a super specialty setting. Wound infection (92 cases, 34%) and chest infections (71 cases, 26%) accounted for the majority of complications. Similar results were obtained by Mohil RS (35% and 20% respectively). Wound infections could be attributed to the large number of patients who had gross peritoneal contamination resulting from hollow visceral perforation resulting in local contamination of the incision site. A raised diaphragm, upper abdominal incision and gross peritoneal contamination resulting into higher rates of chest infections in our group.

CONCLUSION

The present study suggests that P-POSSUM is one of the scoring systems for predicting post-operative adverse outcome among patients undergoing major general surgeries. No correlations were found in our study except only one parameter i.e., ECG. It might be due to limited sample size and short duration of study. Adequate and prompt correction of these factors before surgery could decrease the mortality rate. This study therefore validates P-POSSUM as a valid means of assessing adequacy of care provided to the patient to prevent the post-operative complications which can further lead to morbidity and mortality. Hence 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 preventing the anticipated complications in the emergency laparotomy cases.

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