Evaluation of P - POSSUM Scoring System in Patients Undergoing Emergency Laparotomy

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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 April 2014 - April 2015 for one year. 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. Physiological scoring was performed just before surgery and operative scoring was carried out intra-operatively. Patients were followed-up for the first 30 days postoperative period. The observed mortality rate was compared with the P-POSSUM predicted mortality rate. Data analysis was done using SPSS 20.

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 of 1.18 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 (x^2 = 1.467, 4 df., P = 0.833). In all the risk factors studied, 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

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To cite this article: Jha MK, Sibakoti YC, Devkota H. Evaluation of P-POSSUM Scoring System in Patients Undergoing Emergency Laparotomy. Medical Journal of Shree Birendra Hospital. 2017;17(2): 28-36.

DOI: http://dx.doi.org/10.3126/mjsbh.v16i2.17714

Conflict of Interest: None declared

INTRODUCTION

Comparing the influence on adverse outcome, we can assess the efficiency of that particular procedure and assess the quality of care provided to the patient.[1,2] Risk scoring seeks to quantify a patient's risk of adverse outcome based on the severity of illness derived from data available at an early stage of the hospital stay.[3,4] Scoring should cover all prospects of patient care and should be easy to use, fast, and comparable among different patient groups. The Physiological and Operative Severity Scoring system for the enUmeration of Morbidity and mortality (POSSUM) has been proposed as a risk adjusted scoring system to allow for direct comparison between the observed and expected adverse outcome rates.[5,6] It has 12 physiological and 6 operative variables. Each factor is assigned scores depending upon the severity.[5] The Portsmouth POSSUM (P-POSSUM) is a modification of the POSSUM scoring system, incorporating the same variables and grading system, but a different equation, which provides a better fit to the observed mortality rate, which is an important and objective measure of outcome.[7,8]

It has already found use in general[9], vascular[10-13], colorectal[14-16], esophageal[17,18] and laparoscopic[19] procedures but the studies mostly involved patients in developed countries, where the patient characteristics, presentation and available resources differ from our setup.[20] 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 because such studies have not been done in this part of world and, try to analyze the causes for poor outcome in these high-risk group.

METHODS

This was a prospective study conducted in a tertiary level referral hospital of Kathmandu, Nepal for a duration of one year from April 2014 - April 2015. Every case presenting for emergency laparotomy under general surgery for one-year period were included in this study after assessment of the inclusion criteria and cases were followed up for 30 days following the surgical procedure. Patients above 14 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 14 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 Score used for the study:-

Parameters/ Score	1	2	4	8
Age (Years)	<60	61-70	>71	
Cardiac Signs	No Failure	Diuretic, Digoxin, antianginal or antihypertensive therapy	Peripheral edema, Warfarin Therapy	Raised JVP
Chest X-Ray	Normal	--	Borderline Cardiomegaly	Cardiomegaly
Respiratory History	No Dyspnoea	Dyspnoea on Exertion	Limiting dyspnoea (one flight of stairs)	Dyspnoea at Rest (rate > 30/ min)
Chest X-Ray	Normal	Mild COAD	Moderate COAD	Fibrosis or Consolidation
Blood pressure (systolic)(mmHg)	110-130	131-170 or 100-109	> 171or 90-99	< 89
Pulse (beats/min)	50-80	81-100 40-49	101-120	> 121 < 39
Glasgow coma Scale	15	12-14	9-11	<8
Hemoglobin(g/dl)	13-16	11.5-12.9 or 16.1-17.0	10.0-11.4or 17.1-18.0	≥18.1
White cell count (×1012/l)	4-10	10.1-20 or 3.1-4	≥20.1 or ≤3	
Blood 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 or 5.1-5.3	2.9-3.1 or 5.4-5.9	≤2.8 or ≥6
ECG	Normal	--	Atrial fibrillation (rate 60-90)	Any other Changes

Operative severity score used for the study. Mortality is (Loge [R/1-R] = - 9.065 .+ (0.1692 x Physiological Score) + (0.155 x Operative Score) Where R = risk of mortality. [8)]

	1	2	4	8
Operative severity	Minor	Moderate	Major	Major Plus
Multiple procedures	0	1	2	>2
Total blood loss (ml)	<100	101-500	501-999	>1000
Peritoneal soiling	None	Minor (serous fluid)	Local pus	Free bowel content, pus or blood
Presence of malignancy	None	Primary only	Nodal metastases	Distant metastases
Mode of surgery	Elective		Emergency resuscitation of >2 h possible, Operation < 24 h after admission	Emergency (immediate surgery <2 h needed)

Table 1. Indications for emergency .laparotomy

Indications	Frequency	%
DU perforation	19	31.7
Appendicular perforation	10	16.7
Intestinal Obstruction	9	15
Ileal perforation	7	11.7
Jejunal Perforation	7	11.7
Obstructed Hernia	4	6.7
Others	4	6.7
Total	60	100

Table 2. Complications

Complications	%	Frequency
Wound infection	48.3	29
Chest infection	26.7	16
Anastomotic leak	6.7	4
Hypotension	13.3	8
Respiratory failure	8.3	5
Wound dehiscence	20.0	12
Impaired renal function	3.3	2
Septicemia	6.7	4
UTI	6.7	4
Cardiac failure	8.3	5
Others	3.3	2
None (no complications)	40.0	24

RESULTS

A total of 60 patients who met the inclusion criteria were included in this study. Out of which 54 (90%) patients were male and 6 (10%) patients were female. Age of the patient were ranges from 16-81 years. Among them 55 (91.7%) were of <= 60 years, two (3.3%) of 61-70 years and 3 (5%) were of >70 years.

Among 60 patient undergoing emergency laparotomy, 19 patients were operated for duodenal ulcer perforation. Other indications were appendicular perforation, intestinal obstruction, ileal perforation, jejunal perforation and obstructed hernia in descending sequence. There was patient with ruptured hydatid cyst, traumatic bladder injury, Blunt abdominal trauma (BAT) with liver injury and with mesenteric ischemia each. (Table 1)

The post-operative complications noted during the 30 day follow up period are listed in (Table 2). Among 60 operated cases only 24 patients did not develop any complications in 30 days immediate post-operative period.

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 ($x^2 = 1.523$, df 4, P = 0.823).

We found positive rate of increment with all the risk factors studied but it was found to be statistically significant with respect to hemoglobin (p = 0.001), WBC (p = 0.002), Urea (p = 0.001), sodium (p = 0.019), potassium (p = 0.030), peritoneal soiling (p = 0.001) and Mode of surgery (p = 0.001) (Table 4.).

DISCUSSION

In our institution, peritonitis due to hollow viscous perforation has become the leading cause of emergency laparotomies. In our study, we performed emergency laparotomy in 60 patients. Most of the surgeries were performed on patient with hollow viscus perforations (43 cases 71.66%). In our study nine (15%) patient were operated for intestinal obstruction and four patients with obstructed hernia. Gastro intestinal tract perforations can occur due to various causes, and

Table 3. Comparison of observed and expected mortality rate. O: observed number of deaths, E: expected number of deaths, chi square = 1.523, df= 4, P = 0.823

Predicted mortality rate %	No. of procedures	Mean predicted risk	O	E	O:E
<=11	44	3.62	2	2	1.26
11-19	11	15.21	1	2	0.60
20-29	3	27.17	1	1	1.23
30-39	1	39.56	1	0	2.53
60-69	1	60.40	1	1	1.66
Total	60	8.47	6	6	1.00

Table 4. The analysis of risk factors for low outcome. *significant at 5%, **significant at 1%

	Pearson Correlation	Rate of increment	t	P
Age	0.01	1.48	1.70	0.097
Cardiac sign	0.14	0.15	0.22	0.830
Respiratory History	0.38**	2.09	1.24	0.222
BP systolic	0.34**	0.53	1.67	0.101
Pulse	0.22*	0.66	1.58	0.122
Hb	0.59**	1.76	5.62	<0.001
WBC	0.27*	2.50	3.36	0.002
Urea	0.45**	5.54	6.63	<0.001
Sodium	0.44**	1.81	2.44	0.019
Potassium	0.32**	1.30	2.25	0.030
ECG	0.02	0.28	0.40	0.689
Multiple procedure	0.04	0.37	0.26	0.794
Total blood loss	0.16	0.87	1.28	0.206
Peritoneal soiling	0.18	1.13	4.58	<0.001
Malignancy	0.06	1.41	0.82	0.414
Mode of surgery	0.44**	2.91	5.16	<0.001

most of these perforations are emergency conditions of the abdomen that require early recognition and timely surgical treatment. The main stay of treatment for bowel perforation is exploratory laparotomy. Peritonitis due to perforation of hollow viscous is most common surgical emergency in our part of world which is different from that found in western world.[21]

The treatment outcome whether in the form of mortality or morbidity is not only dependent on the performance of individual surgeon but also on the acute and chronic physiological status of the patient, severity of his current illness, nature and extent of surgical intervention and co-morbid conditions. The morbidity and mortality rates are misleading and inaccurate for surgical audit. For this purpose, different system of scoring were developed for risk prediction and adjusted mortality and morbidity.[1-4] To overcome the shortcoming POSSUM, developed by Copland GP. et al, a risk adjusted scoring system for surgical audit 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.[7,8,14,15,19,22] This is especially true in patients in developing countries like ours where the general health of the population is poor, malnutrition is a common problem and presentation frequently delayed.[19,20,22]

In our study we assessed the validity of P-POSSUM in 60 patient who underwent emergency laparotomy by comparing the observed mortality rate with expected mortality rate. Six patients died (mortality rates of 10%), the total crude mortality rate being 12%. Similar study was done by Tekkis et al and obtained similar results (elective = 3.9%, emergency 25% and overall mortality rate of 11.1%).[15] However, on using P-POSSUM for expected mortality rate in our study it was also found to be six deaths. On analysis, this was found to be no statistically significant difference between the observed and expected mortality rates (Chi square x2 = 1.523, 4 df , p = 0.823). An O : E ratio of one was obtained in our case which is similar to one obtained by Yii MK and Ng KJ. et. al. evaluated POSSUM and P-POSSUM scoring systems for prediction of mortality rates among patients undergoing general surgery in a tertiary referral hospital in Malaysia (O : E = 1.28).[20]

Tekkis et al analysed mortality in patients undergoing gastrointestinal surgery using POSSUM and P-POSSUM scoring systems. A total of 505 consecutive patients undergoing major gastrointestinal surgeries were analysed. The observed mortality rate was 56 deaths, while the expected mortality rate using POSSUM was 108 deaths, which was found to be a significant over prediction (x2 test = 44.82, 4 d.f., p<0.001). Using P-POSSUM, the expected rate was 57 (x2 test =3.34, 4 d.f., p = 0.51). Comparison suggests P-POSSUM as the recommended scoring system for risk adjusted performance measurement (O : E = 0.98).[15] Similar results were found when Mohil R. et al. compared POSSUM and P-POSSUM for predicting the adverse outcome rate in patients undergoing emergency laparotomy.[22] P-POSSUM was able to accurately predict the adverse outcome following emergency laparotomy in our study also.

In our study on analysing the risk factors we found positive rate of increment with all the risk factors studied but it was found to be statistically significant with respect to hemoglobin (p =0.001), WBC (p = 0.002), urea (p = 0.001), sodium (p = 0.019), potassium (p = 0.030), peritoneal soiling (p = 0.001) and mode of surgery (p = 0.001). Wound infection (48.3 %) was found to be the most common complication, followed by the chest infection (26.7 %). Similar results were obtained by

Mohil et. al.[22] (35 % and 20 % respectively). Large number of individuals with gross peritoneal contamination after hollow viscous perforation leading to local contamination of the incision site may attribute to wound infections.

CONCLUSION

The present study suggests that P-POSSUM is an accurate scoring system for predicting post-operative adverse outcome among patients undergoing major general surgeries. The complications of wound infection and chest infection were 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. Hence 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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