International Surgery Journal
Manoharan GV et al. Int Surg J. 2019 Feb;6(2):512-517
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20190394

Original Research Article

Evaluation of possum scoring system in patients undergoing laparotomy

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Received: 07 August 2018
Revised: 11 December 2018
Accepted: 29 December 2018

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ABSTRACT

Background: Prediction of complications is an essential part of risk management in surgery. Knowing which patient is at risk of developing complications contributes to the quality of surgical care and cost reduction in surgery. Among the variety of scoring systems used to identify the "high risk" patient POSSUM scoring is the most widely used.
Methods: Patients undergoing laparotomy were selected serially and their physiological severity score on admission and operative severity scored at the end of 30days and compared with the POSSUM predicted score.
Results: In the elective surgery group, patients with morbidity correlated with high POSSUM scores but due to low overall morbidity conclusions could not be drawn while in the emergency group predicted morbidity correlated well with observed results. The low overall mortality in the study group precluded meaningful analysis.
Conclusions: POSSUM scoring system has an undeniable advantage in this set up for better patient counseling, improving the surgical outcomes in both emergency and elective wards and for better management of limited resources and manpower.

Keywords: Morbidity, Mortality, Outcome predictors, POSSUM, Scoring system

INTRODUCTION

This is an exciting time in medicine. The pace of risk management is an important health care issue. Prediction of complications is an essential part of risk management in surgery.[1] Knowing which patient is at risk of developing complications contributes to the quality of surgical care and cost reduction in surgery. It is therefore essential to identify and make appropriate decision on those patients who are at high risk of developing serious complications. Physiological and operative severity score for the enumeration of mortality and morbidity (POSSUM) has been used to produce numerical estimate of expected mortality and morbidity after variety of surgical procedures. POSSUM is a patient risk prediction model based on 12 patient characteristics and 6 characteristics of the surgery performed. It can be used in hospital setting to provide educational information. It integrates well in the existing hospital programs without causing any disruptions of hospital activities. When other scoring systems were compared with POSSUM, it was shown that POSSUM results were much more useful in predicting the outcome of surgery for patients. Various studies with POSSUM in various countries with different health systems and socio-economic status showed that there was no change in POSSUM ability to predict outcome of surgery. It was developed by Copeland GP et al, and has since been applied to several surgical groups including orthopedic patients, vascular surgery (AAA, carotid endarterectomy etc.), head and neck surgery and GI/Colorectal surgery.[2-5] POSSUM is becoming more widely used in the UK as surgical culture moves more towards outcome measures and providing the patient with as much information as possible to make fully informed consent.[6] Furthermore, a system that uses risk adjusted prediction is going to become an essential tool for clinical

governance reviews to 'prove' a unit's performance and for an individual consultant surgeon's appraisal process for much the same reason. POSSUM used exponential analysis and a report from Whiteley et al, claimed that POSSUM over predicted death in their group of patients especially in low-risk patients. To counteract this effect the original POSSUM equation was modified leading to the Portsmouth predictor equation for mortality (P-POSSUM) utilizing the same physiological and operative variables. This method used linear analysis.[7] Further studies have since shown the use of POSSUM and P-POSSUM to predict mortality equally well. Even the P-POSSUM model still overpredicts mortality in low-risk groups but is a better 'fit' than POSSUM.[8,9]

METHODS

This was a descriptive study done on 154 patients who underwent midline laparotomy in this institute from October 2016 to October 2017. The sampling method were purposive. The patients of age group 16 to 80 years undergoing midline laparotomy were included and the day-care surgery patients, patients who died immediately before surgery were excluded.

Procedure

Method of sampling was non-random, purposive. After admission short history was taken and appropriate workup done on each patient admitted in surgery department for laparotomy. Baseline investigations, as routinely required were done followed by imaging studies. Patients were then explained about their disease process and the possible line of management.

All the necessary information regarding the study was explained to the patients or their valid guardian. Informed written consent was taken from the patients or their guardian willing to participate in the study. Thorough physical examination was done in each case. Data collection sheets were filled in by the investigator himself. All the preoperative factors related to the patient were noted down in the data sheet. After proper evaluation and preparation, patients who required surgical management were taken up for surgery. All patients were operated under general anesthesia. Strict aseptic precautions were followed during the operation. Meticulous techniques were practiced as far as possible. The operation procedure and related preoperative factors were observed directly and recorded in the data collection sheet instantly. After completing the collection of data, it was compiled in a systematic way. All the patients/legal guardians were explained the study and about the investigative and operative procedures with their merits and demerits, expected results and possible complications. If he/she agreed, then the case had been selected for this study. The study did not involve any additional investigation or any significant risk. It did not cause economic burden to the patients. The study was approved by the institutional review board prior to commencement of data collection. Informed consent was taken from each patient/ guardian. Data were collected by pre-tested structured questionnaire. Data were collected from all the respondents by direct interview after getting informed written consent from them or from their legal guardian. The physiological severity was scored on admission and operative severity at the end of 30days. Data analysis was done both manually and by using computer. Calculated data were arranged in systemic manner presented in various table and figures and statistical analysis was made to evaluate the objectives of this study with the help of Statistical Package for Social Science (SPSS).

RESULTS

The distribution shows that 42.2% of the study was done in elective patients and the rest was in emergency surgeries.

Table 1: Distribution of elective and emergency surgeries in the study.

Surgery	Numbers	Percentage
Elective	65	42.2
Emergency	89	57.8
Total	154	100

The distribution shows the different age groups in the study population and the sex ratios in each age group. No stratification was done to match the age groups and sex ratios among the emergency and elective study groups (Table 2).

Table 2: Age and sex distribution in the study group.

Age/sex	Elective			Emergency			Total
	Male	Female	Total	Male	Female	Total	
<29	2	3	5 (3.2)	15	7	22 (14.3)	27 (17.5)
30-39	6	3	9 (5.8)	9	10	19 (12.3)	28 (18.1)
40-49	10	11	21 (13.6)	12	8	20 (13)	41 (26.6)
50-59	12	4	16 (10.4)	9	4	13 (8.4)	29 (18.8)
>60	10	4	14 (9)	8	7	15 (9.7)	29 (18.8)
Total	40	25	65 (42.2)	53	36	89 (57.8)	154 (100)

Table 3: Distribution of risk factors in the study group.

Risk factor	Elective	Emergency	Total
Cardiac risk	1	5	6
Respiratory risk	9	18	27
Total	10	23	33

Cardiac and respiratory risk factors were considered for POSSUM scoring and patients in the emergency group had higher risk.

Table 4: Vital parameter distribution in the study group.

Parameters	Elective		Emergency	
	Within range	Outside range	Within range	Outside range
SBP	51 (78.5)	14 (21.5)	65 (73)	24 (27)
PR	62 (95.4)	3 (4.6)	11 (12.4)	78 (83.6)
GCS	65 (100)	0	78 (83.6)	11 (12.4)

Systolic blood pressure, pulse rate and Glasgow coma scale of the patients were considered for POSSUM scoring. Deviations from the norm were more in the emergency group of patients.

Table 5: Blood analysis values in the study group.

Parameters	Elective		Emergency	
	Within range	Outside range	Within range	Outside range
Hb	60	5	73	16
TC	54	11	55	34
Urea	58	7	64	25
Na+	63	2	79	10
K+	51	14	53	36

Table 5 shows the blood investigation values of the study population in the elective and emergency groups. The values tend to deviate from the norm much more in the emergency group compared to the elective surgery group.

Table 6: Distribution of operative findings.

Procedure details		Elective	Emergency
Operative severity	Major	52	86
	Major	13	3
No. of procedures	One	65	83
	Two	0	4
	>Two	0	2
Blood loss	<100ml	10	4
	100-500ml	41	58
	500-1000ml	14	10
	>1000ml	1	17
Peritoneal soiling	None	64	27
	Blood	-	9
	Bowel contents	-	16
	Local pus	1	37
Malignancy	None	38	82
	Primary alone	6	1
	Nodal spread	10	2
	Distant spread	11	4

Table 6 analyses the operative findings as to the severity of the surgical procedure, number of procedures performed, blood loss encountered, the presence or absence of peritoneal soiling and the presence and spread of malignancy. Table 7 categorizes the various causes of morbidity in the study population with the variations between the elective and emergency groups. Lung complications were more common in the elective group while wound complications were more common in the emergency group.

Table 8 categorizes the various causes of mortality among the study population with the variations between the elective and emergency groups. The most common cause of mortality was multiorgan dysfunction. There was no mortality in the elective group.

Table 7: Causes of morbidity in the study group.

Morbidity	Elective	Emergency
ARDS	1	3
Basal atelectasis	4	3
Anastomotic leak	1	3
DVT	3	-
Wound infection	1	9
Wound dehiscence	1	11
Pulmonary embolism	-	3
Pneumonia	1	6
Hypokalemia	1	-
AKI	-	4
UTI	1	4
Total	13 (20)	46 (51.7)
None	52 (80)	43 (48.3)
Total	65	89

The p value is 0.026 which is significant. This showed that the POSSUM score correlated well with the observed values of morbidity (Table 9).

The low rates of mortality in the study precludes any meaningful analysis. Hence, drawing conclusions about mortality from the study results needs further data and study (Table 10).

Table 8: Causes of mortality in the study group.

Mortality	Elective	Emergency
MODS	-	3
SIRS	-	1
Sepsis	-	1
None	65	84
Total	65	89

Table 9: Comparison between predicted and observed morbidity values.

Expected morbidity (%)	Elective			Emergency		
	Total no. of patients	Patients with morbidity	%	Total no. of patients	Patients with morbidity	%
0-10	3	0	0	0	0	0
10-20	23	0	0	0	0	0
20-30	7	2	28	6	0	0
30-40	5	1	20	13	2	16
40-50	12	3	25	10	3	30
50-60	4	2	50	9	2	22
60-70	6	3	50	4	1	25
70-80	1	0	0	9	6	67
80-90	4	3	75	5	4	80
90-100	0	0	0	33	28	85

DISCUSSION

This prospective, observational and descriptive study was conducted among 154 purposively selected patients who had underwent midline laparotomy for elective or emergency causes in Department of General Surgery, Stanley Medical College and Government General Hospital. The study was carried out with a view to determine the validity of POSSUM scoring in predicting the morbidity and mortality of patients undergoing midline laparotomy. The standards of the institution compared to the general accepted level of morbidity and mortality was also analyzed.[8] In this study, there were a total of 154 patients. Of these 65 patients (42.2%) had underwent elective laparotomy while eight nine patients (57.8%) were taken up for laparotomy for emergent causes (Table 1).

More than sixty percent of the patients were males with a male:female ratio of 3:2 (Table 1). The patients ranged from thirteen years to ninety years. But the predominant age group involved was 40-60 years in the elective group while in the emergency group, there was no specific predominance with even distribution of patients (Table 2). There were a greater number of patients in the younger age group (<30yrs) in emergency group- 5 vs 22. In total nearly, thirty percent of patients belonged to the 40-50 age group, this being significant, due to more prevalence of comorbid factors in the older age group.

The POSSUM score includes the presence or absence of features of cardiac or respiratory problems. In this study, only one patient had cardiac risk in the elective group while five patients had cardiac risk in the emergency group. Respiratory signs were more prevalent with nine patients in elective group and eighteen patients in the emergency group, having them (Table 3). A study of risk factors for peritonitis by Ramachandra ML et al, showed that cardiac risk factors were the most common co-morbidity in the patients operated.[9] The vital parameters studied in POSSUM score include the systolic blood pressure (90-120mm of Hg), Pulse rate (60-90/min) and

GCS (15). An analysis of these parameters showed that the elective group patients had stable vitals with all patients having a GCS of 15 with only three patients having tachycardia and fourteen patients with hypo/hypertension which can be due to age related changes. In the emergency group, as expected more than eighty percent of the patients had tachycardia with low GCS seen in as many as eleven patients, hypotension also being more prevalent with twenty seven percent having abnormal systolic blood pressure (Table 4).

The blood investigations included in the study are hemoglobin, total count, urea and serum electrolytes. In the elective group, nearly all patients had these investigations with the normal range but in the emergency group, a significant number of patients had deranged parameters, with nearly forty percent having elevated total count and electrolyte abnormalities (Table 5).

In the elective group, 13 out of 65 patients had underwent major surgery as per the POSSUM guidelines. All patients had only a single procedure with blood loss being less than 500ml in more than seventy five percent of patients. Only one patient had peritoneal soiling in the form of local pus. 27 patients were malignant patients with eleven of them having distant metastasis and the surgical procedure being purely palliative. In the emergency group, only three patients had a major surgery, with six patients having one or more repeat surgeries. Blood loss was also higher with seventeen patients having more than 1000ml blood loss. Peritoneal soiling was also very common, with 37 patients having localized pus collections, spillage of bowel contents seen in sixteen patients and hemoperitoneum in nine patients. Only 7 of 89 patients had malignant disease (Table 6). In a study on laparotomy in peritonitis by Malangani MA et al, 85% of patients had a single procedure with no complications, 12% had surgical soiling and 3% had severe blood loss and fecal contamination.[10]

20% of elective patients had morbidity while more than 50% of emergency patients having morbidity. Wound related complications was the predominant cause of morbidity in patients undergoing emergency laparotomy while basal atelectasis and venous thrombosis more commonly seen in elective patients. Pulmonary complications were also more common in emergency group (Table 7).

None of the elective patients died in the post-operative period while 5 patients in the emergency laparotomy group died with three people due to multi organ dysfunction, one due to sepsis and one due to SIRS (Table 8).

In elective patients, there expected to observed morbidity was similar but significance couldn't be attributed as the prevalence of morbidity as such was low in that group. Among those who had post-surgical complications, their POSSUM score was high, indicating a good specificity of the score (Table 9).

In the emergency group, the correlation was significant with the predicted morbidity levels being the same as what was seen in the study. Out of the 50 odd patients who had a morbidity predicted percentage of more than seventy, 42 patients developed post-surgical complications indicating a high level of sensitivity and specificity for the score to predict morbidity (Table 9). In a study by Durairajan LN et al, on morbidity related with peritonitis, higher mortality was observed in the high-risk group with statistically significant correlation with multiple risk factors.[11] With regards to mortality, the low rates of mortality in the study precludes any meaningful analysis (Table 10). Among the five patients who died, their POSSUM predicted mortality percentage was more than 90 in 4 of the cases and conversely out of the 6 patients who had a POSSUM score of more than 90%, 4 patients died. This again indicates a high level of sensitivity and specificity of the score to predict mortality. Risk assessment scoring in colorectal cancer studied by Tekkis PP et al, showed similarly higher mortality with more than 2 comorbidities.[12] Chi-square analysis of the significance of POSSUM score to predict morbidity among this study group patient showed a high level of significance <0.001.

CONCLUSION

In today's era, where the patient's safety and proper management of patient is of utmost importance, it becomes only necessary to assess the expected outcome of the procedure performed. Recognizing patients who are at high risk to develop complications and who have high risk of mortality would prompt us to take necessary and timely action and aid us in the better management of the patient. An ideal scoring system should be applicable to a wide range of general surgical procedures, both elective and emergency and should allow the prediction of both morbidity and mortality with reasonable sensitivity and specificity. In the past numerous scoring systems like ASA and APACHE II have been used to predict both morbidity and mortality in surgical patients. These existing scoring systems are either too simple or too complex and do not meet the expectation as being readily applicable to all patients. POSSUM has been proved to be one of the best scoring systems that could predict the morbidity and mortality risk with reasonable accuracy. It has been validated by many authors around the world and has been a successful tool in surgical audit. It has been used by many authors in various surgical specialties with success, though it was found to slightly over predict morbidity and mortality. POSSUM morbidity equation can reasonably predict morbidity in high risk groups whereas the sensitivity falls in elective conditions. Predictive value improves when linear analysis is used, and results improve dramatically when exponential analysis is applied. POSSUM mortality equation over predicts mortality especially in low risk

groups, while the predictive value improves significantly when exponential analysis is used. Hence, POSSUM scoring system has an undeniable advantage in the set up for better patient counseling, improving the surgical outcomes in both emergency and elective wards and for better management of limited resources and manpower.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Manoharan GV, Vijayalakshmi G. Evaluation of possum scoring system in patients undergoing laparotomy. Int Surg J 2019;6:512-7.